



Imperial Agricultural Bureaux
Fifth Annual Report
OF THE
Executive Council
1933-1934

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LONDON

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PREFACE

Many delegates to the Imperial Agricultural Research Conference, 1927, especially those from Overseas, stressed the difficulties they had experienced in obtaining information in different countries of research in various branches of agricultural science and in getting into touch with research workers in other countries. The Conference felt that these common difficulties should be met by a common effort.

2. It accordingly recommended that eight bureaux be established to collect, collate and disseminate information on research in selected branches of agricultural science, and generally to assist research workers in the Empire with information on their subject and with introductions to other research workers. Each bureau was to deal with one of the following branches of agricultural science and be located at an Institute already well known for research in its branch.

Soil Science	Plant Genetics (other than Herbage)
Animal Health	Plant Genetics (Herbage)
Animal Nutrition	Fruit Production
Animal Genetics	Agricultural Parasitology

The cost was to be met from a common fund formed by contributions from Empire Governments.

3. These proposals were accepted and a scheme for the finance and administration of the bureaux was prepared at a representative meeting held in London in November, 1928. The acceptance by governments of this scheme brought into being a new type of Imperial organisation. Since 1st April, 1929, a service of common Empire interest has been maintained from a fund jointly subscribed by the Governments of the Empire and administered by an Executive Council composed of representatives directly appointed by the governments for that purpose.

4. By locating the bureaux at selected research institutes the officers are in daily touch with men engaged in research in their own subject and profit by the guidance and assistance of the Heads of those Institutes. The organisation controlling each of the selected Institutes has allowed the Head of that Institute to act as Director of the Bureau. Each bureau thereby receives the help which only men of wide experience and scientific distinction can give. Other officers of the bureaux are whole-time servants of the Council.

5. In addition, each bureau has in each country of the Empire an official correspondent, who is "the general friend" of that bureau in that country. These official correspondents are appointed by the different governments of the Empire for their interest in the particular branch of science with which a bureau deals.

6. On the adoption by governments of the recommendations made by the Imperial Committee on Economic Consultation and Co-operation, the Executive Council was made responsible for the supervision of the administration and finance of the Imperial Institute of Entomology and of the Imperial Mycological Institute with effect from 1st October, 1933.

REPORT

At its meeting on the 19th December, 1934, the Executive Council of the Imperial Agricultural Bureaux adopted the following report relating to its fifth year's work—1st April, 1933, to March, 1934.

I.—EXPANSION IN THE DUTIES OF THE EXECUTIVE COUNCIL

In June of 1933 the Imperial Committee on Economic Consultation and Co-operation presented its report to Governments. This Committee had been appointed in pursuance of one of the Resolutions adopted at the Ottawa Conference

“to consider the means of facilitating economic consultation and co-operation between the several Governments of the Commonwealth, including a survey of the functions, organisation and financial bases of the agencies specified in the annexed report, and an examination of what alterations or modifications, if any, in the existing machinery for such co-operation within the Commonwealth are desirable.”

The Executive Council of the Imperial Agricultural Bureaux was one of the “agencies specified in the annexed report.”

2. That Committee summarised its principal recommendations as follows :—

“(a) *Scientific Information Services and Research Activities*

(1) We recommend that the Executive Council of the Imperial Agricultural Bureaux should be entrusted with the supervision of :—

(a) the administration and financial control of the eight Imperial Agricultural Bureaux;

(b) the administration and finances of the Imperial Institute of Entomology, and the Imperial Mycological Institute;

(NOTE.—We recommend that, should it be so desired, there should be constituted also in respect of each of these Institutes a scientific advisory committee to assist the Director on scientific, as opposed to administrative and financial, questions.)

(c) such research activities in the United Kingdom as the participating governments may agree should in future be conducted on a co-operative basis.

(2) We recommend that the question of what research activities should in future be carried out co-operatively should be considered at a

conference to be summoned as early as possible, consisting partly of the administrative and scientific heads of national research organisations and departments, and partly of such other persons as the several governments may select. We recognise, however, that there are difficulties in the way of the meeting of such a conference in the immediate future and we accordingly recommend that the Executive Council of the Imperial Agricultural Bureaux should be invited by the governments of the Commonwealth to consider immediately the question of the research activities which should, in its opinion, be conducted on a co-operative basis and to prepare a report for presentation to the conference referred to above. If it is not possible for that conference to meet within a brief period of the completion of its report, we recommend that it should be presented direct to the governments of the Empire.

(3) We recognise that conferences of the type proposed would be the appropriate body to initiate additional proposals for co-operative action in regard to scientific research, but owing to the difficulties of holding such conferences frequently, we recommend that it should be within the competence of the Executive Council of the Imperial Agricultural Bureaux from time to time to submit proposals on this matter."

3. In the body of its report it had also recommended that,

(i) the representation on Council of the United Kingdom should be on the same basis as for the Dominions (*see* in this connection paragraph 2 of Council's report for 1932-33).

(ii) Whilst no attempt should be made at that time to reassess the basis of allocation of the contributions from governments to the Imperial Institute of Entomology and the Imperial Mycological Institute, the hope was expressed that those Governments that have reduced, or temporarily withdrawn, their contributions to these two Institutes would feel able to restore them to their former basis.

(iii) in regard to such research "as the governments may agree should be undertaken co-operatively and which is now being financed by the Empire Marketing Board, the contributions which the Governments may decide to make should commence on 1st October, 1933."

(iv) an additional sum of £1,800 a year should be provided for the cost of the extra work thrown on the Headquarters Staff of the Council as a result of the additional duties recommended to be entrusted to it.

4. The Entomological and Mycological Institutes are older organisations than the bureaux, having been started in 1911 and 1920 respectively. In fact the bureaux were to a certain extent modelled on them. In addition,

however, to the work which a bureau performs these Institutes undertake the identification of insects and fungi of economic importance. The Imperial Committee on Economic Consultation and Co-operation reported that the work which these two Institutes have performed "has been of value to the whole of the Empire and should be continued."

5. By the 26th October, 1933, all governments in the Empire had notified their acceptance of the recommendations contained in the report of the Imperial Committee on Economic Consultation and Co-operation. Immediate effect was given to these decisions, the constitution of the Council was remodelled and the supervision of the administration and finance of the Institutes was transferred to the Council.

6. By that time, however, the future of many of the research schemes previously financed from the Empire Marketing Fund had become a matter of urgency as financial provision in that Fund had expired on the 30th of September, 1933. In some cases promises of financial assistance had been made over a period of years extending beyond 30th September, 1933. Such cases were dealt with directly by His Majesty's Government in the United Kingdom. Other schemes, which had received aid, were either so nearly complete or were of such preponderantly local interest as not to necessitate consideration of the possibility of providing funds by joint contributions. But, even when all such had been eliminated, there still remained a number for which future finance was uncertain. Time and circumstances did not permit the assembly of a conference, "consisting partly of the administrative and scientific heads of national research organisations and departments, and partly of such other persons as the several governments may select" to consider the future of those schemes. In the middle of November, 1933, the governments of the Empire directed Council to consider these schemes and report direct to governments.

7. In this annual report of 1933-34, therefore, the record of work of Council is considered under three heads :—

- A. The Bureaux.
- B. The Institutes of Entomology and Mycology.
- C. The Research Schemes.

The funds of each Institute have been and are kept separate and are distinct from those of the bureaux. This was deemed to be advisable in view of their past history and of differences in the contributions of the various governments and appeared to be in consonance with the intentions of the Imperial Committee on Economic Consultation and Co-operation. Auditors' statements relating to the accounts of the bureaux and of each Institute are attached. The expenditure incurred by Council is included under that of the bureaux.

II.—THE COUNCIL

8. *Personnel*.—Changes in membership in Council were more numerous than usual. Sir Robert Greig and Dr. Scott Robertson resigned and Sir Charles J. Howell Thomas was appointed as the sole representative on Council of the United Kingdom. Lt.-Colonel G. P. Vanier was appointed as Canada's representative, on the understanding that at any time that Dr. G. S. H. Barton, Deputy Minister of Agriculture, Ottawa, was in England, he would sit as a member of Council. Mr. J. M. Adams succeeded Dr. J. H. Hinchcliffe who had represented the Irish Free State on Council since its formation and as such had taken an active share in the early organisation of the bureaux' work. Sir Bhupendra Nath Mitra, High Commissioner for India, was appointed by his Government to represent India in place of Mr. A. Yusuf Ali, whose period of office as originally determined by his government had expired.

9. Whilst the Empire Marketing Fund was in existence the Council had indirectly received considerable assistance in its Headquarters expenditure. For instance, the Imperial Economic Committee had, in 1929, agreed to Council appointing as its Secretary, Sir David Chadwick, who at the time was Secretary to the Imperial Economic Committee and as such drew his salary from the Empire Marketing Fund. For his services to Council an honorarium of £100 was the only charge against Council. As a result of the decisions of governments on the report of the Imperial Committee on Economic Consultation and Co-operation, the Imperial Economic Committee was placed on a contributory basis with effect from 1st October with a constitution very similar to that of Council. The Council and Committee each appointed Sir David Chadwick as its Secretary and the Council undertook to bear a portion of the salary more commensurate with the time which the work of the Council entails. In addition the Council undertook to pay one-fifth of the cost of a part of the Headquarters Staff of the Imperial Economic Committee. These arrangements were more economical than the establishment of a separate office for Council, though inevitably the charge is greater than when the Empire Marketing Board gave accommodation and assistance in generous terms. Council arranged in consultation with the Treasury and the Dominions Office that its accounts, though now more numerous, should continue to be kept for it by the Accounts Branch of the Dominions Office on a repayment basis. With the increased work the cost is naturally greater than previously but it is much cheaper than appointing a special accounts section and moreover ensures that all accounts are kept and scrutinised by a fully trained staff. The Council is grateful for this assistance.

III.—THE BUREAUX

10. *Personnel*.—During the year two new posts of scientific assistants were created, one at Aberdeen and one at Aberystwyth. Dr. W. W. Snedden was appointed to Aberdeen and Miss M. Hall, B.Sc., to Aberystwyth. Miss

M. L. C. Wilson, B.A., was transferred from Edinburgh to Cambridge and the staff at Edinburgh was reduced, temporarily, by one Assistant Secretary.

Dr. Fraser Darling, the Chief Officer at Edinburgh, having during the year the honour of a Leverhulme Research Scholarship, resigned the service of the Bureaux with effect from 31st March, 1934. Miss M. V. Cytovich has been placed in direct charge of the bureau work and Mr. J. H. Kenneth appointed as a Scientific Assistant.

11. *Accounts.*—In accordance with previous practice the figures shown in the audited statement are net, after deducting from the expenses of each bureau receipts received by it from sales of publications.

12. The contributions due from governments in 1933-34 exceeded those in previous years by £900, being a half year's additional provision for Headquarters' expenditure as adopted by governments on the recommendation of the Imperial Committee on Economic Consultation and Co-operation. The total therefore due was £20,770. The total received in the year was £20,581, made up of £19,870, the full total of the amounts due in the year under the original bureaux scheme, and £711 towards the additional £900, the liability for which only arose in the course of the financial year. For reasons connected with budgetary arrangements, the outstanding balances were received after the 1st April, 1934, and do not appear in these accounts.

13. The net expenditure during the year was £19,922 0s. 7d.; but the arrangements at Headquarters between the Imperial Economic Committee and the Council, referred to in paragraph 9 above, were not fully carried out until after the close of the financial year. As finally determined and settled, the cost in 1933-34 to the Council under the heading of General Secretarial Expenses was £1,107 3s. 9d. or £571 8s. 2d. above the sum actually expended in the year.

14. Receipts from sales of publications (excluding those for Nutrition Abstracts and Reviews issued from the Aberdeen Bureau under the arrangements described in Council's report for 1931-32), amounted to £1,679 6s. 11d. Gross expenditure in 1933-34, including the sum of £571 8s. 2d., was therefore £22,172 15s. 8d. as compared with gross £19,245 16s. 8d. in the previous year. The chief increases came under extra cost at Headquarters (£407), normal increments in salaries and new appointments at the bureaux (£1,532), increase in the printing bills of the bureaux (£831—of this £600 was recovered in increased sales *vide* next paragraph) and visits of bureaux officers abroad and to Empire Countries (£294).

15. The figure of £1,679 quoted above for receipts from sales of publications (excluding Nutrition Abstracts and Reviews) compares with £1,080 and £989 in the two previous years. Practically all bureaux contributed to this increase.

Receipts from Sales of Publications

	1930/31	1931/32	1932/33	1933/34
Animal Health—Weybridge	£ 116	£ 756	£ 735	£ 1,161
Plant Genetics (Non-Herbage)—Cambridge ..	1	46	77	123
Fruit Production—East Malling	3	55	61	115
Plant Genetics (Herbage)—Aberystwyth ..	—	38	54	83
Animal Genetics—Edinburgh	—	7	12	79
Soil Science—Rothamsted	6	51	57	73
*Animal Nutrition—Aberdeen	—	19	54	22
†Animal Parasitology—St. Albans	—	13	15	18
Headquarters	—	4	15	5
TOTAL	126	989	1,080	1,679

* Figures exclude receipts from sales of Nutrition Abstracts and Reviews.

† Under arrangement, the bureau abstracts are published as a supplement to the Journal of Helminthology.

The above increased receipts are due partly to increases in sales, partly to the increase in the rates of subscription for the Journals issued by the bureaux at Cambridge, East Malling and Aberystwyth, but chiefly to the issue during the year of the Index Veterinarius from Weybridge.

16. In the year 1933–34 sales of Nutrition Abstracts and Reviews realised £841 8s. 3d. as compared with £840 and £632 in each of the two previous years. Total receipts from sales of publications issued directly from the bureaux therefore exceeded £2,500. This figure has been reached in five years of difficult times and is in itself a testimony to the general value of the work of the bureaux; but only at Weybridge—Animal Health—did receipts in the year meet the expenditure on printing and duplicating. Printing charges for the bureaux exceeded receipts by £1,220 and for Nutrition Abstracts and Reviews by £288; but in this connection it must be borne in mind that there is of necessity a very substantial free issue of publications to government departments and research workers throughout the Empire.

The Year's Work

17. *Tours.*—The progress made with the abstract journals has figured prominently in previous reports. But the preparation and issue of such journals is not the only service which the bureaux were designed to perform. The Imperial Agricultural Conference of 1927 insisted that what might be termed the “library” side of their work should not absorb all their activities. They wished that bureau officers should maintain close contact

with research workers and as far as possible become familiar with the problems under investigation in the various parts of the Empire. With this object the Conference insisted that each bureau should be attached to a research institute, active and well known in its own branch, and deprecated any idea of locating all the officers at some geographically convenient central library. The contact with research workers was to be a live one and not a paper one.

Although a bureau conducts no research itself, it should none the less, if it is to serve its purpose, be regarded, both in theory and in fact, as an integral part of the group of workers in the Empire engaged in the extension and application of knowledge in its branch of agricultural science. Then will those workers consult and use it freely, and the help it is endeavouring to give will be given with understanding and knowledge. This sense of solidarity in a common endeavour is best fostered by direct personal contacts—visits to bureaux by officers from overseas, visits overseas by bureaux officers. It is gratifying that visitors to the bureaux are increasing in numbers. The cost of journeys by bureaux officers falls on Council. Owing to the cost, to the constant attention which a new venture inevitably demands in its early stages and to the difficulty of arranging for the conduct of work at a bureau during the prolonged absence of its chief officer, visits to Empire countries have not been as frequent as Council would have desired. In 1933-34, however, two were arranged—Mr. Jacks (Rothamsted) visited Canada, Dr. Hudson (Cambridge) Ceylon and India. Council is very grateful for the welcome accorded to those officers, for the arrangements made for them and for the insight given to them of the work in progress. Both returned with sharpened interest in their work and with widened knowledge.

18. Slightly different in their purpose but equally important are visits by bureaux officers to selected research stations in foreign countries. Empire workers, in their attempts to keep abreast of progress, find most difficulty in regard to work in foreign countries and look especially to the bureaux for assistance in learning about it. The foreign contacts of a bureau are therefore important. In 1933-34 Dr. White (Aberystwyth) visited Germany, Austria, Czecho-Slovakia and Hungary.

19. *Technical Communications*.—Fourteen technical communications were issued from the bureaux in the year. These are for the most part reviews, with full and up to date bibliographies, of knowledge on particular scientific problems; though at times the subject may be a review of the work on a particular subject in a particular country, or of the technique adopted in investigating particular problems. It is a healthy sign that several of the bureaux are finding an increasing demand for these technical communications, judging by the requests which reach them from different parts of the Empire. The utility of a technical communication to one engaged or about to engage on an investigation is undoubted; but clearly these papers take time to prepare. The demand for them is more restricted than for a general abstract

journal, and consequently they are apt to become relatively more costly. Among the fourteen issued in 1933-34 the following may be mentioned :—

Review of the tests for baking qualities of wheat (with special reference to tests of small samples for use by wheat breeders).

Soil erosion.

Plant breeding in the Soviet Union.

Helminths in the biological control of insect pests.

Technique employed in grassland research in New Zealand.

Grassland research in Australia.

The technique of artificial insemination.

Land amelioration in Germany.

The first of these was prepared by the Librarian of the Research Association of British Flour Millers at the suggestion of the bureau at Cambridge. Its bibliography contains references to over 700 papers. This large number indicates both the difficulties which plant breeders everywhere have experienced in determining ultimate baking qualities from the small samples obtainable in their experiments and the importance to them in their work of being able to make such early determination.

20. Two further advances were made in the year in the systematic periodical distribution of information.

The Bureau of Animal Genetics, Edinburgh, converted its previous small pamphlet into an abstract journal appearing quarterly, similar in object to those already established by other bureaux. This new journal received immediate support.

The Bureau of Animal Health—Weybridge—began the quarterly issue of *Index Veterinarius*. This ambitious and laborious task was undertaken in response to requests from some of the leading Veterinary Research Institutes in the Empire, which desired to receive promptly full copies of the indexes of veterinary literature maintained at the bureau. As explained in previous reports Council did not feel justified in undertaking this work until promised subscriptions covered the cost of duplication: the subscription is £4 per annum. That stage was reached and the *Index* was started with effect from the 1st January 1933. The first number covers the literature received at or traced by the bureau in the quarter, January to March; the second that from April to June and so forth. The *Index* is at present issued mimeographed and the first volume (*i.e.*, the one covering the year 1933) contained 1,700 pages. It would be more convenient in size if printed, but it is doubtful whether the increased cost can be provided. Difficulties in organisation and execution were naturally encountered at first; but by December, 1934 the issue was up to date. It is hoped that this *Index* will secure a permanent place in the libraries of all veterinary and research institutes.

21. At Rothamsted (Soil Science) and at St. Albans (Agricultural Parasitology), an individual service has been developed. Rothamsted has offered

to send to any research worker in the Empire, who so desires, all references as soon as they come to hand, of papers and literature bearing directly on the problems on which that research worker is engaged. St. Albans supplies each month certain Research Institutes in different parts of the Empire with loose leaf slips giving all current references, thus enabling the reference index in those Institutes to be kept up to date.

22. At Aberystwyth the occasional articles on grassland research in different countries and on the technique of experiment are now collected and issued from time to time under the title of "Herbage Reviews." instead, as hitherto, of being included at the end of issues of Herbage Abstracts.

23. In all the bureaux the year was one of increased activity and development. The number of visitors to the bureaux grew and the contacts between the bureaux and workers in both Empire and Foreign countries increased. An increased number of enquiries from workers in the Empire, especially for information of work performed or in progress in foreign countries, were received.

IV.—(a) THE IMPERIAL INSTITUTE OF ENTOMOLOGY

(b) THE IMPERIAL MYCOLOGICAL INSTITUTE.

24. The transfer to the Council of the administration and financial control of these Institutes took effect from 1st October, 1933. Previously in each case the supervision had been in the hands of a Managing Committee appointed by and responsible to the Secretary of State for the Colonies. The transfer was carried through with a minimum of administrative inconvenience. The accounts of the two Institutes had in the past been audited by the Director of Colonial Audit who has audited the accounts of the whole of 1933–34 for Council.

25. A striking illustration of the difference between these Institutes—especially the Institute of Entomology—and the bureaux lies in the fact that whilst the bureaux are still winning their places in their branches of science the Review of Applied Entomology issued from the Imperial Institute of Entomology is now in its 22nd year, and the Review of Applied Mycology is now in its 13th year. That by itself gives an idea of the long service and experience behind these Institutes.

26. Another difference affects their functions. One of the chief functions assigned to these Institutes at the time they were founded was the identification of specimens sent to them. This adds a branch of activity to their work for which no parallel exists in the work of the bureaux.

The general utility of a well-organised centre for the collection, abstraction and dissemination of information in particular branches of science is widely recognised. It is the justification for the bureaux and for the "bureaux" activities of these two Institutes. The need for an organised centre to aid

entomologists and mycologists in identification is, perhaps, not so fully realised outside entomological and mycological circles. Yet both the farmer and the administrator ultimately rely on those scientists for advice, the one in regard to remedial measures, the other in regard to quarantine measures. Correct identification must lie at the root of all such advice and the species and kinds of insects and fungi are so numerous that research workers find expert assistance in identification at times essential. Except probably in agricultural parasitology, which also covers many species, requests for assistance in identification are not likely to arise in the subjects dealt with by the bureaux, but, in entomology and mycology, assistance in identification of specimens is one of the essential services of a properly organised centre of information.

The Imperial Institute of Entomology and its Finance

27. As the Director—Sir Guy Marshall—shows in his report, a copy of which is attached (Appendix I), the Institute has built up an extensive organisation to cope with these demands for identification. The work can only be done with the aid of specialists in the many different species. In addition to the entomologists on the staff of the British Museum the Institute has, for this work, secured the help of over 60 other specialists, many of them in foreign countries and all of whom, with only two exceptions, undertake this work for the Institute free of charge. Clearly those arrangements can only continue whilst the Institute does its share in specialised identification and maintains the high position it has attained as a centre for information on applied entomology. On the other hand, provided that position can be maintained, entomologists in every part of the Empire (however isolated they may be), have, through the Institute, at their service when they need it, a valuable reservoir of expert knowledge.

28. The opening paragraphs of the Director's report show that this service is widely used by entomologists within the Empire. The difficulty is to cope with the demands made. The collections received in 1933–34 for identification contained 106,700 specimens sent in from all parts of the world by 181 correspondents; whilst from the Institute 386 lists of identification containing the names of 8,287 species were sent to correspondents. Of these over 6,700 were in answer to enquiries from entomologists within the Empire. The Institute also presented to the British Museum 50,300 specimens, of which 470 were types of species new to science.

29. The Imperial Institute of Entomology is responsible for the preparation of three periodical publications on entomology. Two of these are issued by the Institute itself, the third forms part of the Zoological Record issued by the Zoological Society of London.

(a) The Bulletin of Entomological Research which has appeared regularly since 1910 was the first, in point of time, of the Institute's regular publications. It is a quarterly containing original articles dealing with harmful insects.

The articles are scientific in character and of a type hardly suitable for local agricultural journals. In the 1933 volume were included papers contributed by entomologists working in the United Kingdom, Australia, Kenya, Nigeria, Fiji, Palestine, Sudan, Russia, Sweden, Brazil, Iraq.

(b) The second, in point of time, of the Institute's publications is the Review of Applied Entomology,—in 1933 in its 21st year. It is a monthly journal containing reviews and abstracts of every book or article published throughout the world bearing on injurious insects. It has a high reputation as an up-to-date review.

(c) In 1922 the Institute undertook the preparation of the Insect portion of the Zoological Record. This is an annual volume of some 400 pages containing:—

(i) a list showing every paper dealing with entomology published in the year;

(ii) a concise subject index to those papers;

(iii) a list of every new species of insect described during the year and all other information on the classification of insects.

30. Both in its work on identification and in its work on systematic collection and dissemination of information the Institute renders a service to entomologists unobtainable elsewhere in the world. In addition to this regular work the aid of the Institute has been sought from time to time by Governments in the investigation of particular and difficult problems. For instance, at the present time it is the international centre for co-ordinating all work on locust research. This work is conducted under the direction of the Committee on Locust Control of the Economic Advisory Council. International co-operation is effected by periodic Conferences which at first were annual and are now biennial. Each country controls the work in its own territory. It was also through the Institute that the Laboratory for the supply of beneficial parasites (*see* paragraph 43) was organised and started, the cost being met until 30th September, 1933 from the Empire Marketing Fund.

31. *Finance*.—The year's working closed with a net credit balance of £848 11s. 8d. (*see* the statement of the Director of Colonial Audit, attached to this report) owing to the receipt within the year of £1,200 contributions due in the previous year. The Third Imperial Entomological Conference which met in 1930 had noticed that unless contributions were increased deficits would be bound to occur. To meet those deficits and to provide for additional work which the Conference recommended should be undertaken, an annual expenditure of £18,070 in each of the five years up to 1935–36 was estimated as necessary. The Conference requested that contributions should be increased to provide that sum. Owing to the financial depression not only did those increases not materialise, but certain governments reduced or

temporarily withheld their contributions. In place of an increased income the Institute suffered a loss of some £2,230 a year. The increased activities were not undertaken and in addition to temporary cuts in salaries and to economies in maintenance a reduction in the work done on identification was effected, with the result mentioned in paragraph 28. Further economies cannot be effected without stopping some of the essential work for which the Institute was designed.

32. The Imperial Institute of Entomology is situated in the Natural History Museum, South Kensington, S.W.7, with a branch near by at 41, Queen's Gate for its publication work.

The Imperial Mycological Institute—Its Work and Finance

33. This Institute is housed in its own building in Ferry Lane, Kew, adjoining Kew Gardens. The building was provided in 1930, two-thirds of its cost being borne by the Empire Marketing Fund and one-third from the reserves which the Institute had, at that date, accumulated. The work undertaken by the Institute in Mycology is very similar to that undertaken by the Imperial Institute of Entomology in Entomology. Aid in identification of fungi and bacteria, the collection of information in regard to them, and the systematic collection and dissemination of information on the diseases and injuries they cause are just as necessary in mycology as in economic entomology.

34. In this work of identification the Institute does not rely solely on its own staff but has succeeded in enlisting the free co-operation of some thirty specialists in other countries. One instance will illustrate the need mycologists find for this type of specialist aid. During recent years the Institute has received samples of a mould causing a maize leaf disease in Kenya, from guinea grass in Tanganyika, from swede and lettuce seed and rotting apples in England, from potato tubers in New Zealand, from soil in Canada, from butter in Ireland, from imported bamboo (origin unknown) in England, and from various sources in the United States, Java and Holland. This mould had been given at least 13 different generic names and many more specific names in the past, and none of the previous workers appears to have had any suspicion of the wide distribution and varied habitat of the organism. Though the species are not so numerous as in entomology, identification is work for specialists. There are also additional difficulties. To ensure correct identification it is frequently necessary to cultivate the fungi (or "grow them on") especially since no good text-books at present exist for several large groups, and systematic knowledge of the fungi of many parts of the Empire is almost wholly lacking. Identification therefore involves also a certain amount of investigation. The Institute's aim is to be able to name any fungus sent to it for identification. Many hundreds are so sent from the Dominions and Colonies.

35. An account of the work of the Institute in 1933-34 is given in the Director's—Dr. E. J. Butler's—report (Appendix II). In the investigation

work, undertaken solely to afford data for correct identification, attention has been chiefly given to :—

(i) certain large groups of fungi that are inadequately known but are frequently encountered by mycologists and plant pathologists ;

(ii) the critical study of certain small groups which are both economically important and in marked need of revision, so as to determine accurately the species represented, their geographical distribution and the plants each of them attacks.

36. The chief publication issued by the Institute is the Review of Applied Mycology which appears monthly. Each year's volume forms a full indexed collection of abstracts of all applied mycological information of the year. Copies of original papers are lent or translations supplied when required by correspondents.

37. The Institute has in the past frequently been consulted by different governments in the Empire regarding the difficult subject of measures to prevent the introduction of new plant diseases into their countries. It has also assisted in the compilation of lists of fungi in particular Empire countries.

38. It has been the practice since the foundation of the Institute to convene an Imperial Mycological Conference every five years. The third of such Conferences fell due in 1934-35. In view of the great value of those Conferences in the past, the Managing Committee decided, in the summer of 1933, but not without hesitation owing to the general financial difficulty, that the balance of advantage lay in asking governments to allow their mycologists to attend such a Conference in 1934-35. It fell to Council later in the year to consider this proposal. After reviewing all circumstances Council came to the same conclusion as the Managing Committee. The account of that Conference will be dealt with in the report for 1934-35, but Council would like to acknowledge here the action of governments in sending their mycologists to the Conference which was held in September, 1934. More governments and administrations were represented than at any previous Conference.

39. *Finance*.—The statement of the Director of Colonial Audit attached to this report shows a deficit on the year's working of £279 14s. 1d., but in this connection it should be observed that one contribution of £300 due for the previous year 1932-33 did not come into the accounts until the year 1933-34. The real deficit on the year was therefore £579 14s. 1d. The continuance of deficits of this order causes anxiety to the officers at the Institute and to Council.

40. In the figure £6,360 shown as contributions of governments £300 on account of the previous year and £50 were contributed by a non-Empire government, leaving £6,010 as the sum received as contributions falling due from Empire governments in the year 1933-34. In 1929, at the time of the

Second Imperial Mycological Conference, contributions from Empire governments amounted to £6,450 and the Conference recommended a total increase of £1,200 a year for the next five years to meet the then deficit and to allow for the increased work which it recommended should be undertaken. A few governments did increase their contributions but others owing to the financial depression reduced theirs, with the result that the Institute has been receiving substantially less than it did five years earlier when the demands on its services were not so great. The economies made by the Managing Committee, viz. the postponement of the increased activities proposed by the 1929 Conference, the postponement of all avoidable expenditure, and the economy cuts on salaries, have been maintained.

V.—RESEARCH SCHEMES

41. Research schemes scattered throughout the Empire had received financial aid from the Empire Marketing Fund. A list of them is printed in the Appendix to the Report of the Imperial Committee on Economic Consultation and Co-operation. As explained in paragraph 6 above, the task devolved on Council of submitting to governments for their consideration its conclusions in regard to the future financing of many of these schemes. In January, 1934 Council submitted a report which all governments accepted.

42. In the autumn of 1933 uncertainty as to the future was especially felt at institutes, such as the Parasite Laboratory at Farnham House, which had been entirely dependent for finance on the Empire Marketing Fund. That support ceased on 30th September, 1933, and it was not till the middle of November that Council was empowered to commence its enquiries. Had it not been for the undertaking of His Majesty's Government in the United Kingdom to advance for a brief period, whilst discussions were taking place, funds sufficient to keep work going on schemes likely to be continued on a co-operative basis, Farnham House Laboratory would have had to close. It was one of the schemes ultimately selected by Council and accepted by governments for co-operative support.

Farnham House Laboratory

43. The Superintendent's — Dr. Thompson's — report for the year 1933–34 is printed as Appendix III. In spite of the unsettling influences resulting from the difficulties just described, the number of shipments (95) of beneficial parasitical insects was half as many again as in the previous year and the numbers of specimens shipped (1,220,000) nearly four times as large. These larger shipments are the direct result of higher standards of work at the Laboratory arising from improvements in technique and the accumulation of experience. Such advantages are cumulative, and already experience in 1934–35 shows that the demands made on the Laboratory exceed those in any previous year and are being met.

44. During the year Canada, New Zealand, and Australia made very considerable use of the facilities the Laboratory offers. In many instances biological control of destructive pests offers the best, and sometimes the only practical means of keeping such pests under control. Both the study and the supply of parasites of insect pests is, however, a specialised branch of applied entomology. The fact that an insect is regarded as a destructive pest in one region and is looked upon with comparative indifference in another may be due to the absence in the former region of a parasite which in the second locality keeps the pest under control. Yet just because its destructive results are not so apparent in the second locality, it not infrequently happens that the real cause of this comparative immunity—the existence and life history of a particular parasite—has not been exhaustively studied or, perhaps, even recorded. Knowledge of parasites controlling insect pests and of their occurrences becomes therefore a specialised branch of applied entomology in which experience has special value. It also frequently happens that, when biological control of pests is to be applied, the necessary parasite has to be sought in regions far distant from those in which the pest has become destructive. The Superintendent's report (Appendix III) records, for instance, a case in which it was necessary to try biological methods of control to a pest (*Diprion polytomum*) doing great damage to forests in Canada, and the necessary parasite had to be sought in the forests of Europe. In 1932 the Laboratory was able to ship to Canada 3,300 cocoons, and 5,200 in 1933; it has in the current year (1934) shipped over 4 million. Whilst the collection and supply of parasites is perhaps the best known of the functions discharged at the Laboratory, it is by no means the only one. These parasites are frequently extremely small and comparatively little is known about many of them. Much work has still to be done on their identification, on ascertaining the places in which they occur and on the conditions in which they can be multiplied and shipped. By searching past and current entomological literature and adding thereto the results and experience attained at the Laboratory itself, a catalogue containing already some 60,000 cards has been collected of parasites and predators, their hosts and countries of record. Thus is being formed a reservoir of specialised knowledge at the service of entomologists in the Empire not hitherto available. The Laboratory also affords facilities to entomologists from overseas desirous of obtaining experience in this kind of work. Throughout the year one entomologist from Australia was working at the Laboratory and towards the end of the year arrangements were made for a Special Research Assistant attached to the Indian Cotton Committee to receive training for two months in 1934-35.

45. In its early days all costs connected with the Laboratory (including those of collection and shipment of parasites asked for by entomologists in the countries overseas), had been met from the Empire Marketing Fund. In the financial year ending 31st March, 1931, the expenditure on the Laboratory from the Empire Marketing Fund (excluding expenditure on capital account)

exceeded £7,500. In later years overseas departments were asked to make grants towards particular items of work undertaken at their requests, though such grants were frequently insufficient to cover the incidental expenses incurred in carrying out the work, *i.e.*, travelling, handling and shipping material. As finances became more difficult the staff was also reduced, until in the autumn of 1933, when the Council examined the administration of the Laboratory, the specialist staff consisted of the Superintendent, three Junior Entomologists and one Field Entomological Officer. It was impressed on Council that any further reduction would not merely cause the dispersal of experience laboriously acquired, but would so reduce the scientific staff as to render the Laboratory unable to meet the demands which might reasonably be expected to be made upon it. In the proposals for future finance submitted by Council to governments and accepted by them, provision was made for the retention of this minimum scientific staff, but at the same time a system was to be introduced with effect from 1st April, 1934, of charging fees sufficient to cover both all costs of collection and dispatch of parasites and also part of the cost of the scientific staff so engaged. Events have shown that without that staff the demands made on the Laboratory in the summer of 1934 could not have been met.

46. The gross expenditure in the year under review was £6,034 6s. 4d. Receipts, mostly grants towards work undertaken, amounted to £2,014 14s. These were larger than in any previous year. By far the greater part of them was provided by the Entomological Branch of the Canadian Department of Agriculture. The governments of the Empire are responsible under the scheme of joint finance for net costs from 1st October, 1933. For the six months, October, 1933 to March, 1934, the money so needed was advanced as a loan by His Majesty's Government in the United Kingdom and will need to be repaid. This sum amounts to £1,353 19s. 2d.

Stored Products Research Laboratory, Slough

47. Council recommended that the governments of the Empire should provide at the rate of £2,000 a year up to the end of March, 1935, for this scheme of research, which is directed at fundamental research into the problems affecting the control of insects damaging stored products. Light on those problems is clearly of importance to interests in all parts of the Empire. Fumigation is the method usually relied upon for controlling such insect outbreaks; but the results attained in practice have been very varied. Hitherto the choice and strengths of fumigants used have been determined mostly empirically; and problems such as the concentration and diffusion of fumigants, the penetrative effect of gaseous fumigants into tightly packed bales and into small crevices in buildings and problems such as the residual effects of fumigants, if any, on articles subjected to fumigation, remain largely unsolved. The effective use of fumigants is of importance to the agricul-

turalist who stores his grain, to the trader, to the warehouseman, to the transport company, to the manufacturer who carries stocks and to the public health officer anxious to promote healthful housing conditions. Each of these may seek assistance when faced with particularly troublesome cases of infestation, but it is difficult to obtain their financial support for continued investigation into the basic problems on a solution of which the adoption of adequate remedies must rest. The results of this type of fundamental work should be directly helpful to entomologists called on to assist in cases of infestation in stored products or in buildings, ships or warehouses.

In practice the Laboratory applies its methods to infested material occurring in ordinary commerce. During the year much of the infested material on which work was conducted consisted of tobacco and dried fruit, both commodities of interest to several parts of the Empire (see extract from the Director's—Professor J. W. Munro's—Report, Appendix IV.)

48. Until 1st October, 1933, the cost of this work had been met entirely from grants from the Empire Marketing Fund. Therefore, like Farnham House, it was threatened with extinction when that Fund ceased. The Council hoped that interests which stood to profit from this type of work would come forward with financial assistance, but it recognised that the case was urgent. It appeared that the essential features of the work could be maintained at an annual expenditure of £4,000 a year. The Laboratory succeeded in obtaining temporary assistance at the rate of £2,000 a year from the Carnegie Trustees and the Council recommended that the governments of the Empire provide funds up to 31st March, 1935 at the rate of £2,000. The expenditure between 1st October, 1933 and 31st March, 1934 which will fall on governments is £972 3s. 10d.

Low Temperature Research

49. Although research on the storage and transport at low temperatures of perishable foodstuffs was initiated in the United Kingdom primarily in the interest of the United Kingdom consumers, it is clearly of immediate economic interest to those producers in distant parts of the Empire who export considerable quantities of perishable foodstuffs. Before the advent of the Empire Marketing Board some £16,000 to £17,000 a year was being provided by the United Kingdom Government for this work. In the last year of the Board's existence this provision had been increased to £46,000 through substantial grants from the Board's Fund. The governments of Australia, New Zealand, South Africa, Southern Rhodesia and the Colonial Empire agreed for the period from the 1st October, 1933 to 31st March, 1935 to contribute towards this work at the rate of £9,800 a year, on the understanding that (i) "those aspects of this research work in which overseas Dominions are particularly interested should not be curtailed" and (ii) "steps would be taken to ensure effective association of representatives of contributing governments with this research work."

The research work has continued to be conducted with the same outlook and range as before October, 1933; and, after the close of the year to which this report relates, arrangements have been made by the Department of Scientific and Industrial Research whereby representatives of these contributing governments have become members of the Food Investigation Board—i.e., of the Board directly associated with this research work.

50. The joint contributions for these three schemes all take effect from 1st October, 1933, and have only been agreed until 31st March, 1935. They are all subject to review during 1934–35.

Wool Research, Torridon

51. For one other scheme—Wool Research at Torridon—certain governments of the Empire, viz. the United Kingdom, Australia, New Zealand and South Africa agreed to contribute jointly a sum of £2,000 in all during the financial year 1934–35 whilst further discussions took place with the controllers of that research Institute.

The Journal of Dairy Research

52. This journal which had been founded with help from the Empire Marketing Fund has gained a recognised position among dairy research workers in the Empire, for the high scientific level of its papers and abstracts on dairy research. The cessation of the Empire Marketing Fund jeopardised its existence. Council decided to ask permission of governments to use Council funds to an amount not exceeding £250 a year to keep the Journal in existence until its future could be considered at a meeting attended by scientific officers from all parts of the Empire. A report in this sense was sent to governments after the close of the year and was accepted by them.

CONCLUSION

53. The period covered by this report marks a change in the organisation and responsibilities of the Council. Supervision of the administration and finance of two Institutes was transferred to Council with effect from 1st October, 1933. Authority to report on the research schemes in accordance with the recommendations of the Imperial Committee on Economic Consultation and Co-operation was not received from all governments until the middle of November, 1933, yet by the middle of January, 1934, after much investigation and deliberation, the final report was submitted to governments who promptly endorsed the recommendations made to them. Especially on this occasion, the Council wishes to record its appreciation of the work of its Secretary—Sir David Chadwick—whose efforts have contributed so largely to the discharge of these responsibilities.

CHARLES J. H. THOMAS,
Chairman.

THE EXECUTIVE COUNCIL OF THE IMPERIAL AGRICULTURAL BUREAU
ACCOUNT OF RECEIPTS AND PAYMENTS FOR THE PERIOD 1ST APRIL, 1933, TO 31ST MARCH, 1934

<i>Receipts</i>			<i>Payments</i>		
	£	s. d.		£	s. d.
Balance on 1st April, 1933..	1,239	7 9	Working expenses of the Imperial Bureau of—		
Contributions from the Governments of the Empire..	20,581	— —	Soil Science (Rothamsted) ..	2,630	17 6
Dividends and Interest ..	567	5 10	Animal Nutrition (Aberdeen) ..	2,680	15 8
Sale of Investments ...	4,500	— —	Animal Health (Weybridge) ..	3,971	16 10
			Animal Genetics (Edinburgh) ..	1,664	19 9
			Fruit Production (East Malling) ..	1,814	4 7
			Plant Genetics (Herbage)(Aberystwyth) ..	2,492	— 11
			Plant Genetics (Non-Herbage) (Cambridge) ..	2,465	17 1
			Agricultural Parasitology (St. Albans) ..	1,665	12 8
			General Secretarial Expenses ..	535	15 7
				19,922	— 7
			Purchase of £2,000 (nominal) 3½ per cent. Natal Stock, 1939 ..	2,065	4 —
			Purchase of £2,000 (nominal) 4 per cent. Natal Stock, 1937 ..	2,070	4 —
			Interest on Savings Bank Account deposited ..	103	2 6
			H.M. Paymaster- ..		
			General ..	1,807	17 —
			In hand.. ..	869	1 4
				2,676	18 4
			Suspense Account ..	50	4 2
				2,727	2 6
				£26,887	13 7
				£26,887	13 7

Investments at 31st March, 1934.

	£	s. d.
£4,000 5 per cent. Conversion Loan, 1944/64, at cost ..	4,152	16 —
£2,000 3 per cent. New South Wales Stock, 1935, at cost ..	1,935	4 —
£2,000 3½ per cent. South Australian Stock, 1939, at cost ..	1,940	4 —
£2,000 3½ per cent. Natal Stock, 1939, at cost ..	2,065	4 —
£2,000 4 per cent. Natal Stock, 1937, at cost ..	2,070	4 —
Post Office Savings Bank ..	2,603	2 6

(Signed) V. H. BOYSE,

Accountant.

(Signed) DAVID CHADWICK,

Secretary.

24th September, 1934.

I have examined the above Account. I have obtained all the information and explanations that I have required, and I certify, as the result of my audit, that in my opinion the above Account is correct.

G. C. UPCOTT,
Comptroller and Auditor General.

EXCHEQUER AND AUDIT DEPARTMENT,
15th November, 1934.

IMPERIAL INSTITUTE OF ENTOMOLOGY

ACCOUNT OF RECEIPTS AND PAYMENTS RECORDED IN THE YEAR ENDED 31ST MARCH, 1934

To Balance at 1st April, 1933 :—

Balance at 1st April, 1933 :—											
	£	s. d.	£	s. d.		£	s. d.	£	s. d.		
Joint Colonial Fund	2,000	—	—			By Salaries	9,488	3	11		
Crown Agents for the Colonies	460	5	11			Provident Fund ..	1,192	11	8		
H.M. Stationery Office	200	—	—			National Health Insurance contributions..	17	10	5		
Sir Guy A. K. Marshall	24	15	6							10,698	6
				2,685	1	5	<i>Review of Applied Entomology</i>			810	19
Contributions				11,817	2	7	<i>Bulletin of Entomological Research</i> ..			697	3
Interest and Dividends (not)				462	—	9	<i>Zoological Record (Insects)</i>			73	3
Receipts from sales of publications:—							Other Publications			35	18
	£	s. d.					Travelling Expenses			4	4
<i>Review of Applied Entomology</i>	766	6	5				Translators, Identifiers, etc.			18	8
<i>Bulletin of Entomological Research</i> ..	836	10	6				Stationery, Postage, etc.			152	16
<i>Zoological Record (Insects)</i>	228	8	3				Rent, rates, house-keeping, etc. ..			651	9
Other Publications	43	14	11				Books, publications, etc.			114	16
				1,875	—	1	Office Furniture			47	13
							Laboratory and Scientific Equipment			12	0
										13,205	11
							Balance at 31st March, 1934 :—				0

Balance at 31st March, 1934 :—

Joint Colonial Fund	2,500	-	-
Crown Agents for the Colonies	836	2	7
H. M. Stationery Office	200	-	-
	<u>3,536</u>	<u>2</u>	<u>7</u>
Less amount due to Sir Guy A. K. Marshall	2	9	6
		<u>3,533</u>	<u>13 - 1</u>
		<u>£16,839</u>	<u>4 10</u>

15th June, 1934.

(Signed) GUY A. K. MARSHALL,
Director, Imperial Institute of Entomology.

The above account has been examined under my directions. I have obtained all the information and explanations that I have required, and I certify, as a result of this audit, that in my opinion the account is correct.

(Signed) A. J. HARDING,
Director of Colonial Audit.

13th July, 1934.

SECURITIES HELD IN TRUST ON BEHALF OF THE IMPERIAL INSTITUTE OF ENTOMOLOGY
ON THE 31ST MARCH, 1934

<i>Description of Securities, etc.</i>					<i>Per cent.</i>	<i>Amount</i>		
						£	s.	d.
Jamaica, 1952/62	..	..	..	Stock	4	1,000	—	—
Kenya, 1961/71 ..	..	..	..	"	4½	1,017	16	8
Natal, 1937	..	..	..	"	4	1,000	—	—
Nigeria, 1963	..	..	..	"	4	1,000	—	—
Funding Loan, 1960/90	..	..	..	"	4	2,679	19	—
India, 1950/55	..	..	..	"	4½	1,000	—	—
Cyprus, 1956/66..	..	..	..	"	4	1,000	—	—
							£8,697	15 8

IMPERIAL MYCOLOGICAL INSTITUTE

ACCOUNT OF RECEIPTS AND PAYMENTS FOR THE PERIOD 1ST APRIL, 1933, TO 31ST MARCH, 1934

To Balance on 1st April, 1933:—

	£	s.	d.
Joint Colonial Fund	1,700	—	—
Less due to Crown Agents	24	5	7

£1,675 14 5

Cash	1	10	11
Bank	10	16	4

£1,688 1 8

Contributions from Governments	6,360	—	—
Interest and Dividends (net) ..	153	15	5
Receipts from publications ..	589	6	5
F.S.S.U. (Members' repayments)	235	16	—
Health and Unemployment Insurance (Members' contributions)	9	14	6
Miscellaneous receipts	8	9	—

£9,045 3 —

	£	s.	d.
By Salaries	5,356	7	2
Part-time clerical and overtime	10	12	—
F.S.S.U.	718	8	—
Health and Unemployment Insurance	27	6	1
Travelling	19	15	9
Library	50	3	8
Publications	1,041	4	3
Stationery, postage, etc. ..	64	15	8
Rent, rates, insurance ..	97	19	10
Light, heat, cleaning, etc.	170	2	11
Laboratory apparatus ..	46	17	7
Furniture	3	2	6
Audit	30	—	—

£7,636 15 5

Balance on 31st March, 1934:—

	£	s.	d.
Joint Colonial Fund ..	900	—	—
Crown Agents ..	466	2	11
Cash ..	2	15	4
Bank ..	39	9	4

1,408 7 7

£9,045 3 —

Investments:—

New Zealand 4½ per cent., 1944 £2,077 15 4

(Signed) E. J. BUTLER,
Director.

30th November, 1934.

The above account has been examined under my directions. I have obtained all the information and explanations that I have required, and I certify, as a result of this audit, that in my opinion the account is correct.

(Signed) A. J. HARDING,
Director of Colonial Audit.

18th December, 1934.

APPENDIX I

REPORT OF THE DIRECTOR—SIR GUY MARSHALL, C.M.G., D.Sc.,
F.R.S.—ON THE WORK OF THE IMPERIAL INSTITUTE OF
ENTOMOLOGY FOR THE YEAR 1933-34

IDENTIFICATION OF INSECTS

This branch of the Institute's work was well maintained, although the figures are somewhat lower than those for the previous year, which were the highest recorded up to now. In the following details the figures for the preceding year are given in brackets for comparison.

The collections received totalled 417 (520), and these were sent in by 181 (219) different correspondents, who were geographically distributed as follows :—Africa 54, Asia 44, Europe 40, America 24, and Australasia 19. These collections contained 106,700 (113,300) specimens, being an average of over 2,000 specimens a week. During the year 386 (369) lists of identifications were issued, comprising 8,287 (9,602) specified names. The actual numbers of identifications sent out to the Dominions, Colonies and other territories are as follows :—

AFRICA	..	Union of South Africa	..	..	88		
		Southern Rhodesia	..	..	162		
		Sudan	..	..	665		
		Gold Coast	..	..	39		
		Kenya	..	..	789		
		Nigeria	..	..	256		
		Nyasaland	..	..	66		
		Sierra Leone	..	..	401		
		Tanganyika Territory	..	..	92		
		Uganda	..	..	629		
		Other Territories	..	..	341		
					—	3,528	(4,733)
AMERICA	..	Canada	..	..	76		
		West Indies	..	..	275		
		Other Territories	..	..	259		
					—	610	(526)
ASIA	..	India and Burma	..	..	697		
		Ceylon	..	..	54		
		Cyprus	..	..	191		
		Malaya	..	..	284		
		Palestine	..	..	405		
		Other Territories	..	..	732		
					—	2,363	(2,637)
OCEANIA	..	Australia and New Guinea	..	..	298		
		New Zealand	..	..	31		
		Fiji	..	..	213		
		Solomon Islands	..	..	270		
		Other Islands	..	..	164		
					—	976	(880)
EUROPE	..	..	..	..	..	810	(826)

It may be explained that it would be impossible for our own staff to carry out this work even with the help of the entomologists of the British Museum, and it is only feasible because we have made arrangements with over sixty specialists (almost entirely foreigners) to name for us insects belonging to the groups which they particularly study. Except in the case of two specialists, all this work is done for us without charge. No comparable organisation exists anywhere else.

As some indication of the correspondence involved in this work, the following rough analysis of the 1,665 letters sent out from the Head Office alone may be of interest :—Insect identifications, 555; foreign specialists, 237; Dominions and Colonial Offices, Economic Advisory Council, 122; Farnham House Laboratory, 93; commercial firms, 64; letters *re* publications, 65; General, 529.

The insects presented to the British Museum during the year numbered 50,300 (26,200), of which 470 (540) were types of species new to science, and among the remainder were 833 (652) named species not previously represented in the National Collection.

REVIEW OF APPLIED ENTOMOLOGY

Dr. Neave reports that the 21st volumes (1933) of the two Series of the *Review of Applied Entomology* combined contain 1,206 pages, including the indices. They comprise 2,606 abstracts and titles, or slightly under the average for the previous 5 years, which was 2,640. This is not due to any significant falling off in the amount of literature, but merely to a more economical grouping of papers and reports on the same subjects under one heading that has recently been adopted.

It is doubtful whether the world economic depression has done more than check the natural growth of the literature on Economic Entomology, and it must be anticipated that any important economic recovery will be followed by a renewed increase in the literature that has to be abstracted. New fields of research also continue to be opened up, such as, for instance, the relation of insects to the transmission of virus diseases, a subject that is rapidly acquiring an extensive literature.

The standard of up-to-dateness that has always been aimed at in the *Review* was maintained during the year under report, and a given monthly part included abstracts of practically every paper received up to within 7 weeks of publication.

That the *Review* continues to meet the requirements of Economic Entomologists throughout the world is evidenced not only by the appreciative comments received from individuals, but also by the figures of sales both of the current and back volumes, the total receipts during 1933 being £722 8s. 10d. as against £741 16s. 1d. in spite of the general economic conditions. Moreover, the number of subscribers for 1934 (to 30th June) already shows a substantial rise over those for the whole of 1933. There is therefore no reason to anticipate that the increased rate of subscription which is proposed for 1935 will adversely affect the individual sales.

BULLETIN OF ENTOMOLOGICAL RESEARCH

Volume 23, issued in 1933, was slightly larger than the two previous volumes, containing 39 papers by 37 different authors, occupying 599 pages and illustrated by 18 plates (2 of which were coloured and kindly supplied by the Rockefeller Foundation), 138 text-figures, and 4 maps and charts.

The value of this quarterly periodical to Economic Entomologists in the Empire as a medium for publishing the scientific results of their work, which are hardly suitable for local agricultural journals, may be indicated by a statement of the countries from which the papers have emanated : United Kingdom 7, Australia 7, Sudan 2, Kenya 4, Uganda 3, Tanganyika 5, Nigeria 3, Palestine 2, Solomon Islands 1, Fiji 1, Russia 1, Sweden 1, Brazil 1, Iraq 1.

The number of subscribers was 366 as compared with 359 for 1932. The total gross receipts for the year ending 31st December, 1933, were £799 3s. 7d. as compared with £488 13s. 7d. for the previous year, this large advance being mainly due to the increase in price that came into force in January, 1933. The position for 1934, so far as it is possible to predict it, is a satisfactory one. By 30th June, both the number of subscribers and the receipts were already a little higher than at the corresponding date in the previous year.

ZOOLOGICAL RECORD, PART INSECTA

The number of subscribers to Volume 69 was 118 as compared with 128 for the previous year. The sales, including a certain number of back parts, produced a net profit to the Institute of £58 12s. 6d., after deduction of the amount due to the Zoological Society of London, postages, etc. To this must be added the sum of £100 per annum which the Institute received towards the cost of production.

LIBRARY

Accessions during the year numbered 331 volumes (mainly by binding) and 1,219 pamphlets, the collections now totalling 8,098 bound volumes and 19,902 pamphlets. Parts of 566 serial publications were received, including 106 Annual Reports; the number of periodicals (not Annual Reports) received during the year showed a net increase of 7 over the figure for the previous year.

Books and pamphlets issued on loan numbered 663, not counting items lent to Farnham House Laboratory. Amongst Government Departments and Institutions borrowing books may be mentioned the Ministry of Agriculture, the Ministry of Health, the Department of Scientific and Industrial Research, the British Museum (Natural History), the Imperial Mycological Institute, the Imperial Bureau of Fruit Production, the Imperial Bureau of Plant Genetics, and the Imperial Bureau of Soil Science. Books were also borrowed by the Universities of Edinburgh, Liverpool and Sheffield; Armstrong College, Newcastle; University College, Hull; the London School of Hygiene and Tropical Medicine; the Wellcome Bureau of Scientific Research; the Royal Entomological Society of London; the Royal Horticultural Society; the Cambridge Philosophical Society; and the National Central Library. Loans were made overseas to New Zealand, India, Palestine, Tanganyika and the Irish Free State, as well as to one or two foreign countries.

The Catalogue of Serial and Official Publications and the Author-Catalogue of books and separates were maintained up to date; the latter now comprises over 100,000 cards. During the year the entomological contents of 649 volumes were catalogued for the Author-Catalogue, the arrears in this connection being 2,176 volumes of serial publications.

LOCUST INVESTIGATIONS

In 1929 the Committee on Locust Control of the Economic Advisory Council entrusted the Institute with the organisation of research on the locust problem in Africa and Western Asia, and since 1931 the Institute has been recognised by the International Locust Conferences at Rome and in Paris as the international centre for anti-locust research. The work at headquarters is carried out under the supervision of Mr. B. P. Uvarov by a technical assistant and a typist. It consists in the systematic collection of reports on locust breeding and movements in all countries of Africa and Western Asia. Monthly reports are regularly received at the Institute, where they are analysed and mapped, to form a basis for annual surveys. Three such surveys have been prepared, one for the period 1925-1931, and one for each of the years 1932 and 1933. In addition to the monthly reports, all other possible information concerning locusts is being collected, classified and indexed on the decimal system, so that it is easily available.

Another branch of locust investigations is pursued in the locust breeding laboratory, recently established in a room of the British Museum (Natural History). In this laboratory, which is in charge of Mr. A. G. Hamilton, assisted by a laboratory boy, locusts of the three main species are bred for experimental purposes. The experiments now running concern the influence of temperature and humidity on the life-cycle, and are intended to throw light on the life-cycle of locusts as determined by climate. At the same time, the locusts serve as a material for the study of the action of poisons, which is being undertaken at the request and with the financial assistance of the Imperial Chemical Industries, Limited.

Field investigations on locusts in Africa are being carried out by four entomologists. Mr. H. B. Johnston is working in Uganda, where a temporary laboratory has been equipped; Mr. R. C. Maxwell-Darling is investigating the main locust areas in the Sudan, and Mr. A. P. G. Michelmores is doing similar work in Northern Rhodesia and Tanganyika Territory; Mr. D. R. Buxton is assisting in Mr. Johnston's work in Uganda and Kenya without pay. These field investigations have already thrown much light on the locust problem in Africa, more particularly with reference to the original sources of the invasions.

These activities have been entirely financed from special grants made for the purpose by all the British territories in Tropical Africa, and by Palestine and Trans-Jordan. The Empire Marketing Board also gave a sum equivalent to all the other contributions; since the abolition of the Board this amount has been made good from various other sources, and none of the expenditure has been met from the Institute's funds.

GUY A. K. MARSHALL,

Director.

APPENDIX II

REPORT OF THE DIRECTOR—DR. E. J. BUTLER, C.M.G., C.I.E.,
F.R.S.—ON THE WORK OF THE IMPERIAL MYCOLOGICAL
INSTITUTE FOR THE YEAR 1933-34

INVESTIGATIONAL WORK

The study of fungi of economic importance has continued on the following lines:—

Further progress has been made in the study of the large group of fungi which are lower stages of certain higher fungi, though the species of which they are the imperfect stages are known in only a small percentage of cases. Very many plant diseases are caused by these organisms, perhaps half of all the known parasitic diseases of plants, but their study as a whole is the most neglected field of mycology, no doubt because of their microscopic size and the scarcity of good text-books on the subject. The Institute has concentrated on the study of the dark-spored forms, which include, besides plant parasites, a large number of moulds that affect produce such as butter, cheese and milk, cotton and woollen fabrics, tobacco, chocolate, copra, and are also concerned in biological activity in the soil and in the decay of timber.

The primary object of this work is to be able to identify fungi of this group that are sent in for naming in considerable numbers. When it was started about ten years ago the Institute was unable to name or to get named elsewhere a high proportion of these fungi, but the proportion that can be identified has steadily increased. During the past year specimens in this group have been received from almost all the Dominions and Colonies. Those that are obscure are, where possible, grown for further study (a number are already in artificial culture when sent in) and are then in many cases submitted for further opinion to specialists in different parts of the world. The results are published in Mr. Mason's "Annotated Lists" (no part of which was issued during the year, though one was published in March, 1933) or in occasional papers, or referred back to the sender with all available information so that publication can be arranged locally.

Within this large group certain of the more difficult elements have been selected for intensive, monographic treatment. The publication of "The Foundation Species of *Alternaria* and *Macrosporium*" in November, 1933 marks the first stage in the detailed study of this group, the members of which at present cannot usually be correctly named anywhere else.

The staff includes the recognized authorities on some other groups of plant parasites, especially those responsible for blights allied to the potato blight and those causing internal boll rot of cotton and of other fruits. Specimens of these, especially the former, come from many parts of the world and again often require detailed study and almost always growth in artificial culture before they can be named. England, Scotland, Northern Ireland, South Africa, India, Cyprus, Palestine, Egypt, West Africa, Nyasaland, and Mauritius are amongst the countries from which interesting and sometimes destructive examples of these fungi were received during the year.

Another class of destructive fungi, that includes also some belonging to the above groups, which has occupied much time during the past year consists of those that rot fruits, especially in transit or in storage. Most of the recent work has been on fungi rotting bananas, citrus, tomatoes, mangoes and other fruit from overseas.

IDENTIFICATION WORK

Apart from the fungi requiring more detailed study, miscellaneous specimens were received for naming during the year from some 35 Dominions and Colonies. These varied from large collections from Cyprus and some of the African Colonies to smaller parcels or single specimens. The larger collections are mostly sent as a result of the movement for the publication of regional lists of fungi in different parts of the Empire which the Institute has initiated. In a few cases the Institute has arranged for the publication of these lists but more usually this is being done locally. Many of the identifications and most of the references are checked at the Institute before publication. In the routine identification work assistance is required outside the Institute's own staff. The bracket fungi and toadstools are mostly named at the Kew Herbarium, with help in the former group from the Forest Products Research Laboratory, Princes Risborough. Other types go to specialists in the United States, Germany, Scandinavia and elsewhere, some 30 specialists being available in various countries. None of this work is paid for, but the Institute can give a good deal in return, one way or another. The identification work, as a whole, however, is in arrears owing to shortage of staff. Of the four members of the scientific staff one (Mr. Mason) gives his whole time to the identification and investigation of fungi sent in, one (Mr. Ashby) gives almost all his time to the same work in addition to handling all plant parasitic bacteria and assisting the Director in enquiries regarding plant disease, legislation, food transport problems and some other matters, one (Dr. Wiltshire) handles all specimens in the groups allied to *Alternaria* mentioned above, while the Director gives what time he can spare from other work to the identification of some fungi on tropical crops and to fungi of the genus *Pythium*.

INFORMATION SERVICE

The Review of Applied Mycology is the mainstay of this and is run by the Director and Dr. Wiltshire, with three abstractors and two office staff. Volume XII, 1933, consisted of 923 pages, containing 1,641 abstracts, very completely indexed. This was 95 fewer abstracts than the previous year, due to a slight falling off in papers published, which is being made up in 1934. The *Review* endeavours to be complete, missing no serious paper published in any language, and is much more up to date than any other similar journal outside the circle of the Imperial Agricultural Bureaux. The standard of the abstracts was reported during the year by several British and foreign workers to be the best known to them.

The receipts were £609 against £666 the previous year, the total distribution being on 31st March, 1934, 940 against 963 at the same date in 1933, and a maximum of 1,038 in December, 1932. Of these 940, 517 were subscribers, 269 were free copies supplied to contributing Governments, and 154 were exchange copies against other journals. This is believed to be the highest circulation of any journal devoted solely to the subject, with the exception of the American *Phytopathology*, a journal of original papers and not of abstracts. The falling off in circulation since 1932 is common to both journals and is in great part, no doubt, the result of the depression, especially in the United States.

An important part of the information service is conducted by direct correspondence, which takes up much of the Director's time, aided by Dr. Wiltshire and Mr. Ashby. Of the 1,977 letters issued during the year, probably one-third were replies to specific requests for information. These cover practically the whole field of economic mycology and plant pathology.

The lending library is also an important instrument in this service. It now comprises some 15,000 titles, several hundred of which were issued on loan during the year. The books in the main library, which number some 4,500, are not lent except in special circumstances. During the year Australia, New Zealand, Mauritius, Kenya, Tanganyika, the Gold Coast, Sierra Leone, Egypt, Cyprus, and Trinidad made use of the lending library, in addition to frequent borrowing in the United Kingdom.

Translations *in extenso* from papers in less commonly known languages were asked for by only three or four correspondents during the year. A charge has to be made for these as they have to be done out of office hours.

The Institute has endeavoured to keep in touch with developments in spraying apparatus, technique, and the introduction of new or improved fungicides. Enquiries on these subjects are fairly frequent and on several occasions during the year arrangements were made for getting tests carried out in various Empire countries.

No additions have been made during the past two years to the card index of the fungi recorded on the chief tropical crops up to 1922, after which the *Review* index covers the field sufficiently. The index contains between 40,000 and 50,000 cards and sections of it are available for purchase at the cost price of copying.

Requests for the examination of type specimens, and for procuring authentic material or cultures of fungi for overseas workers were received from about a dozen correspondents. These have often to be obtained from abroad and sometimes entail a good deal of correspondence. In addition arrangements were made for the interchange of material for study between workers in other countries, as the Institute has almost unique facilities for doing this.

MISCELLANEOUS

The three laboratories for overseas workers available at the Institute were occupied during a considerable part of the year and have all been in practically constant occupation since its close. There is no doubt that this facility (made possible by the provision of the new building) is greatly appreciated by workers in other parts of the Empire and their presence is an undoubted advantage to the staff.

The banana quarantine glass house in Kew Gardens has been kept under supervision by Mr. Ashby and the Director, and in addition numerous experimental consignments of cacao seed from the West Indies have been grown in quarantine at Kew under the Institute's supervision with a view to sending the seedlings on to the Gold Coast, where legislation prohibits the uncontrolled import of western cacao varieties because of the danger of introducing witches' broom disease. As usual the Institute has been consulted frequently regarding legislation against plant diseases and this is regarded as one of its most responsible duties, the value of which has been fully recognized by several of the overseas Departments of Agriculture during the past year.

Noticeable success seems to have attended the Institute's efforts to introduce fungal parasites of scale insects into the Seychelles. In addition to the red fungus sent the previous year a virulent white-spored species obtained from India was successfully introduced last winter and has proved very active in killing certain scales.

E. J. BUTLER.

Director.

Kew, 24th October, 1934.

APPENDIX III

REPORT OF THE SUPERINTENDENT—DR. W. R. THOMPSON,
F.R.S.—ON THE WORK OF THE FARNHAM HOUSE LABORATORY,
FOR THE YEAR ENDED 31st MARCH, 1934

Owing to the fact that no final decision was taken at the Ottawa Conference of 1932 concerning the future of the Empire Marketing Board, from which the Laboratory obtained the greater part of its revenue, the financial year 1933-34 opened in an atmosphere of uncertainty and financial restriction. The position was not materially improved by the publication of the report of the Imperial Committee on Economic Consultation and Co-operation, which recommended that the Executive Council of the Imperial Agricultural Bureaux should be entrusted with the supervision of such research activities in the United Kingdom as the participating Governments may agree should in future be conducted on a co-operative basis (Cmd. 4335, p. 91, para. 358 (a) (i) (C)) without specifying, for co-operative support, any of the schemes hitherto financed by the Empire Marketing Board. The Empire Marketing Board itself came to an end on 30th September, 1933 before any arrangements had been made for the co-operative support of the Laboratory, so that it became necessary to give the members of the staff three months' notice of termination of appointment, as from the date mentioned. Even by the end of the financial year, the position of the Laboratory had not been definitely settled.

In spite of the serious disadvantages under which it laboured during this period, the work of the Laboratory continued more actively than ever before. Ninety-five shipments of beneficial insects, comprising a total of about 1,219,738 specimens, were despatched to various parts of the Empire.

Country						No. of Shipments		No. of Specimens Shipped	
Canada .. .. .	..	..	..	..	..	40	..	..	720,149
Australia .. .. .	..	..	..	..	..	25	..	..	56,702
New Zealand .. .. .	..	..	..	..	..	4	..	..	427,050
Great Britain .. .. .	..	..	..	..	..	24	..	..	12,857
Foreign States .. .. .	..	..	..	..	..	2	..	..	3,000

This maintenance of its activity was partly due to funds, to the amount of £1,632 5s. 8d., provided by the Entomological Branch of the Canadian Department of Agriculture, for work on several insects of special interest to Canada, and £305, subscribed by the New Zealand Government and the farmers of the Hawkes Bay District of New Zealand, for the collection of parasites of the Cabbage White Butterfly; but it was also due to the fact that during the six years that had elapsed since its foundation, the standard of work at the Laboratory had steadily improved owing to the steady increase of experience of the permanent staff and the temporary workers employed from the village of Farnham Royal. As a result of their experience and training in our special field of work, the staff has now developed into an efficient and harmonious organisation, able to tackle the most difficult practical problems at short notice, with great rapidity and a minimum of expenditure.

The main projects taken up by the Laboratory during the financial year 1933-34 have been as follows :

INSECTS AFFECTING CEREAL AND FORAGE CROPS

WESTERN WHEAT-STEM SAWFLY (*Cephus cinctus*, Norton).

This insect is a native of North America, and formerly only attacked wild grasses, but spread from them into the adjacent wheat fields when the Western Provinces of Canada were brought into cultivation. The larva lives and feeds inside the stalk of the wheat-plant. It moves downwards as it develops, and when it is full-grown, it spins a cocoon in the cavity of the base of the stem, and before sealing this up it cuts, just above the point where it lies, a circular incision. This incision weakens the stem, which tends to break off prematurely. The damage occasioned by this insect is very serious. In 1927, the loss due to its ravages in the Province of Saskatchewan alone was estimated to be about £2,400,000; and severe outbreaks are common in one or other of the Western Provinces. The native parasites of the Sawfly are unable to control it in the wheat fields; and it is impossible to employ any artificial methods of control against such an insect. In 1929, therefore, we suggested the introduction of the European parasites of a closely allied wheat sawfly (*Cephus pygmeus*, L.) with similar habits. Little was then known about the natural enemies of this insect. Sample collections were therefore made in wheat fields in various parts of England. A thorough study of this material was made in order to determine the rôle and importance of the numerous parasitic insects associated with the Sawfly. This work showed that the parasitic wasp, *Collyria calcitrator*, was the most important factor in the control of the Wheat Sawfly in England, and that the Harpenden and Cambridge areas were the most favourable districts for its collection. Fields in which both pest and parasite were numerous were therefore selected. After the crop had been harvested, the wheat stubble was pulled up by hand and was transported to Farnham Royal. The stubble was cleaned and sorted, and all stems containing cocoons of the sawfly were removed and packed for shipment to Canada. In the winter of 1929-30, 15,000 cocoons, of which a high percentage was parasitised, were sent; 90,000 cocoons were shipped in 1930-31, and about 50,000 in 1931-32. Increased funds provided by the Government of Canada enabled us to extend the work in 1933-34. Five hundred sacks of stubble were collected and 337,250 cocoons shipped to Canada.

As the infested area in Canada is enormous and the population of the pest immensely larger than the number of parasites it has been possible to introduce, a good many years must elapse before the natural enemies exert their full effect. It is therefore quite satisfactory to be able to report that the species introduced has successfully attacked the Western Wheat-stem Sawfly, survived the Canadian winters, and reappeared for several seasons in the field in fair numbers.

In the spring of 1934, after consultation with the Dominion Entomologist, about 2,000 cocoons of one of the less important parasites of the Sawfly were shipped to Canada. The results of this introduction are not yet known.

EUROPEAN CORN BORER (*Pyrausta nubilalis*, Hubn.).

The caterpillar of this insect, introduced into North America about 15 years ago, is extremely injurious to Indian Corn and other plants. It has established itself in Ontario.

At the request of the Dominion Entomologist, the larvae of a South African Maize Borer, which had been parasitised in the laboratory by one of the most important natural enemies of this insect, were obtained from the entomologists of the Empire Cotton Growing Corporation's Experimental Station in Barberton, Transvaal. Several consignments were shipped to Canada, where the parasites were successfully reared and used in experiments with the larvae of the Corn Borer.

INSECTS AFFECTING DECIDUOUS FRUITS

CODLING MOTH (*Cydia pomonella*, L.).

The Codling Moth is the most important insect pest of the Apple. It originated in Europe, but is now distributed over practically all parts of the world where apples are grown. The caterpillars of the Moth burrow into the fruit, rendering it practically unsaleable, having regard to the high standards of the modern market. In some apple growing countries the losses due to the Codling Moth amount to over £3,000,000 per annum.

In view of the general importance of the Codling Moth, an investigation of its parasites was initiated in the early years of the work. The difficult problem of rearing the insect in large numbers in captivity was solved, satisfactory methods for rearing two of the parasites were developed, and an extensive survey of the natural enemies in England and France was carried out. Owing to the financial stringency the laboratory work was eventually discontinued after one of the principal parasites (*Ascegasier quadridentatus*) had been shipped to South Africa and New Zealand. But an extensive report on the parasites, embodying the main facts discovered during the investigation, was prepared by Mr. H. T. Rosenberg, and has now been published in the "*Bulletin of Entomological Research*."

WOOLLY APHIS OF THE APPLE (*Eriosoma lanigerum*, Hauam.).

This pest, known in England as the American Blight, is an aphid which originated in North America, but has now spread to practically all parts of the world in which apples are grown. It has, in America, an important native parasite, the Chalcid wasp, *Aphelinus mali*. This has been introduced into many apple-growing regions, and has, in a number of cases, materially reduced the infestation by the Woolly Aphis. In the United Kingdom it has been distributed for a number of years by the Ministry of Agriculture, but although it has established itself in some areas, it frequently disappears at the close of the season, and requires to be re-introduced from year to year. A stock of the parasite is therefore kept on hand at Farnham Royal, and consignments, estimated to contain about 500 parasites, are supplied to apple-growers at a charge of ten shillings and sixpence, including postage and packing. Satisfactory results are frequently reported. In the early summer of 1933, a colony of 100 individuals of the parasite was placed on an apple tree in the garden at Farnham Royal, with a population of Woolly Aphis estimated at 112,000, in which no parasites had been present. The condition of the aphids was followed week by week by sample dissections. In 67 days the parasitism in the samples taken rose to 100 per cent., so that the infestation was practically annihilated. Two short papers giving an account of this and another similar and equally successful experiment, are now in press.

During the financial year 1933-34, 16 consignments of *Aphelinus* were sent to correspondents in England, while one consignment was despatched to the Egyptian Department of Entomology.

INSECTS AFFECTING FOREST TREES

BARK BEETLES.

This is an extremely important group of insects affecting trees of all kinds. The damage they do is due to the fact that the adults and larvae tunnel through the cambium region. Some confine their attacks to dead or dying trees, but others are able to attack and kill living, healthy trees. In certain cases the adult beetles also cause great losses by feeding upon the shoots of healthy trees. It may also be noted that a temporary weakness induced by heavy defoliation, due to leaf-feeding insects, sometimes allows the bark beetles to make a successful attack, to which the tree succumbs, though, under reasonably favourable conditions, it would have recovered from the effects of defoliation.

No serious attempts have been made in the past to utilise, or even to evaluate, the work of the parasites and predators of Bark Beetles. A few years ago we therefore decided to undertake an investigation of the subject. This investigation, which is being carried out mainly in areas under the control of the Forestry Commission, and in co-operation with its officers, has three main objects:

- (1) The collection of parasites and predators of Bark Beetles for introduction into Empire countries where these pests are troublesome (Canada, New Zealand, South Africa).
- (2) The determination of the part played by beneficial insects in relation to bark beetles in England, under the present system of forest management.

(3) The development of methods of forest management, under which the natural enemies of bark beetles can be maintained at their maximum efficiency as controlling agents.

During the financial year 1933-34, a considerable mass of data bearing on (2) was collected and experiments bearing on (3) were laid down. Early in March, 1933, a consignment of three species of predaceous beetles (*Rhizophagus* spp.), comprising over 3,700 individuals was sent to New Zealand. In October, 1933, a consignment of 1,066 specimens of one of these beetles was despatched to Canada. In February and March, 1934, three consignments of a parasite of bark beetles, comprising over 6,000 specimens, were sent to Canada. This material arrived in good condition in New Zealand and Canada and was liberated in the field; but no reports upon the work have as yet been received.

CHERMES spp.

These are aphids, somewhat resembling the Woolly Aphis of the Apple in superficial appearance, but confined to conifers. One species of the group (*Chermes pini*) introduced from Europe, now does a good deal of damage in the *Pinus radiata* forests of New Zealand, retarding the growth of the trees and sometimes causing their death. Another species (*Chermes* or *Dreyfusia piceae*) causes serious injury to Balsam in Canada, where it is known as the Balsam Bark Louse.

These insects are relatively common in Europe, and rather heavy infestations by some of the species have been observed on Weymouth and Scots Pine in the Bagshot area. They are, however, preyed upon by several species of predaceous insects, including lady-birds, the larvae of certain two-winged flies belonging to the family Agromyzidae (*Leucopis* spp.), and some Neuropterous insects of the family Hemerobiidae. These predators eventually became very abundant in the Bagshot area, so that in the course of a few seasons they practically wiped out the infestation.

Several consignments of one of these predators (*Leucopis obscura*) have been despatched to New Zealand and Canada, and the insects liberated in the field. The entomologist in New Zealand (Dr. David Miller) has been unable to visit the area since the material was liberated, but the predator is known to have become established in Canada. A request for additional material has been received from New Zealand, accompanied by a promise of £30 to cover the expenses of the work, from the Directors of New Zealand Perpetual Forests, Ltd.

EUROPEAN PINE-SHOOT MOTH (*Rhyacionia buoliana*, Schiff).

This is a small moth belonging to the Tortrix family. Its larvae attack several species of pine, and frequently cause serious damage, especially in young plantations, by boring into and destroying the young shoots. When the terminal shoot is affected, as it often is, the replacement of the original leader by a side shoot follows and this causes a more or less pronounced kink or bend in the main stem, which often persists throughout the life of the tree, and very seriously lessens its market value. The Pine-shoot moth is a European insect, but was accidentally imported into the United States and Canada a number of years ago.

A first consignment of material of this species, containing several species of parasites, was despatched to Canada in 1928. Several species were liberated and have become established in the infested areas; but as the infestation has continued to increase the Dominion Entomologist instructed us to secure more material. In the summer of 1933 new collections were therefore made and shipments containing a total of about 530,000 specimens were sent to Canada. From these large numbers of parasites were reared and liberated; several species of these parasites have since been recovered in collections made in Canada.

WHITE SPRUCE SAWFLY (*Diprion polytomum*, Htg.).

This sawfly is a European species, but though it has occasionally done some damage, it is rarely of any importance. Several years ago, however, it suddenly appeared in some valuable Canadian spruce forests, in the Gaspé Peninsula, south of the St. Lawrence River, and has spread with unusual rapidity. Its larvae eat the needles of the spruce trees and these, like the majority of conifers, suffer very severely when they are defoliated. One result of the injury is to slow

up the movement of sap in the trees, which then become more susceptible to the attack of bark beetles. In healthy trees, where the rate of sap flow is normal, the injury caused by the beetles in making their tunnels, causes a heavy flow of resin which may trap and stifle the beetles in their galleries, while those attacking sickly trees are able to continue their excavations, weakening the tree still further, and sometimes killing it.

Owing to the relatively inaccessible character of the area invaded by the Spruce Sawfly, artificial measures of control are impracticable. The distribution of poisonous dusts by aeroplanes has been considered, but its cost would be in the neighbourhood of £80 a square mile, and as some 7,000 square miles are affected the method is impracticable. Early in 1932, the Dominion Entomologist therefore requested the Laboratory to undertake a search for the parasites of the insect in Europe. This work was carried out by Messrs. K. R. S. Morris and W. F. Jepson in 1932, and by Messrs. Morris and E. Cameron in 1933 and 1934. *Diprion polytomum* was found to be uncommon everywhere. Three thousand three hundred and twenty-two cocoons were collected in 1932, and 5,229 in 1933. During the winter, 1933-34, one of the principal parasites was given special study at Farnham Royal, a method of breeding was developed, and a considerable number of cocoons parasitised by it were secured and despatched to Canada.

The investigations undertaken here show that most of the important parasites of the Spruce Sawfly can be obtained from other more common sawflies attacking conifers. Arrangements for the collection of these during the season of 1934 have therefore been made.

INSECTS AFFECTING GARDEN CROPS

CABBAGE CATERPILLARS.

In 1930, the common butterfly known as the Small Cabbage White (*Pieris rapae*) appeared for the first time in New Zealand and has since spread rapidly over the Dominion, where it is causing considerable damage to Cabbage and allied crops.

Parasites of this insect were requested by Mr. J. Muggeridge, the Dominion Entomologist. In 1931, 2,415 cocoons of the important Braconid parasite, *Apanteles glomeratus*, were collected and despatched. In 1932, over 90,000 of this species were shipped, and in 1933, 320,000. In 1932, the Chalcid, *Pteromalus puparum*, which is a very effective parasite of the chrysalis of the Cabbage White, was reared in small numbers and bred in the Laboratory. Thirty-four thousand specimens were sent in 1932, 4,000 in 1933, and 3,000 in 1934. Reports received from the Dominion Entomologist state that the introduced parasites have become established. *Pteromalus puparum*, the parasite of the chrysalid, has spread rapidly over the infested area, and in some districts is already destroying 50 per cent. of the chrysalids of the Cabbage White.

PARASITES OF GREENHOUSE INSECTS

GREENHOUSE WHITE-FLY (*Trialeurodes vaporariorum*).

This important pest of greenhouse plants, especially tomatoes, is distributed all over the world. The investigations of Mr. E. R. Speyer, the Entomologist of the Cheshunt Experiment Station, have shown that it can be effectively controlled by the Chalcid, *Encarsia formosa*. In response to requests for this parasite, received from Mr. J. Muggeridge, consignments obtained from Cheshunt, through the courtesy of the Director, Dr. W. Bewley, were despatched to New Zealand in 1930 and 1932. The 1930 consignment was a failure, owing to the unavoidable delays during shipment. The 1932 consignment, however, produced a few adults from which Mr. Muggeridge was able to breed up a colony. He is now distributing the parasite throughout New Zealand.

MEALY BUG.

The insects of this group are very injurious in tropical and sub-tropical countries as pests of a number of plants, such as citrus fruits, coffee, and grapes. In temperate climates they are troublesome as greenhouse pests.

An important natural enemy of mealy bugs, the Australian Ladybird, *Cryptolamius montrouzieri*, has been secured from California and is now being bred in numbers at Farnham Royal, for distribution in greenhouses in this country.

INSECTS AFFECTING DOMESTIC ANIMALS

For some years, the entomologists of the Western United States—particularly those of the State of Montana—have been endeavouring to combat the Cattle Tick, which is a carrier of the very serious Cattle Tick Fever, by importing the Hymenopterous parasites of these Acarina. At the request of the Dominion Entomologist, a supply of these was secured from Paris and despatched to Canada, where parasites were reared from it.

TROPICAL PESTS

WEST INDIAN INVESTIGATIONS.

During the greater part of the last financial year, Dr. J. G. Myers remained attached to the staff of the Laboratory and carried on his investigations under the general supervision of the Institute. He has now been seconded to the staff of the Imperial College of Tropical Agriculture in Trinidad, but we shall remain in touch with him in regard to the technical aspects of his work.

A correspondence and exchange of views with regard to the biological control of the Small Moth Borer of Sugar-cane has been maintained with Mr. R. W. E. Tucker, Entomologist of Barbados, Mr. H. E. Box, Entomologist of Antigua, and Mr. L. D. Cleare, in charge of the special investigations on Small Moth Borer in British Guiana.

BERMUDA.

We have been consulted by the Department of Agriculture of the Bermudas in regard to the control of the Palmetto Scale, and have forwarded recommendations for its investigation, which have been adopted.

MAURITIUS.

Mr. W. F. Jepson, originally a member of the Laboratory staff, was seconded to the Mauritius Government in 1932, to undertake work on the biological control of *Phytalus smithi*, the white grub of sugar-cane. Following a plan of campaign drawn up at the Laboratory, Mr. Jepson visited the United States and Porto Rico, where he studied the methods of handling the parasites of white grubs, and obtained supplies of several parasites and predators of various white grubs. These were transported, via Farnham Royal, to Mauritius, where Mr. Jepson is continuing the investigations under our general supervision.

KENYA.

We have been consulted during the past year by the Kenya Coffee Board with regard to the biological control of the Coffee Mealybug, and have submitted plans, which are now under consideration.

AUSTRALIAN INVESTIGATIONS.

Mr. Stanley Garthside, of the Entomological Division of the Commonwealth Council for Scientific and Industrial Research, assisted by Mr. Frank Wilson, has continued his investigations of the natural enemies of Australian Noxious Weeds and insect pests, under the general supervision of the Superintendent, and has despatched large consignments of a number of beneficial insects to Australia, where some species have now been liberated. Investigations and collections are always made in collaboration with the Australian entomologists when the occasion arises.

VISITING ENTOMOLOGISTS

Among the many visitors to the Laboratory during the year were entomologists from Malaya, British Solomon Islands, India, and the West Indies, France and Denmark, as well as organised parties of students from Public Schools and Colleges.

Arrangements were made for the visit of Mr. H. D. Nangpal, the Special Research Assistant, Pink Boll-worm Investigations, United Provinces Entomological Research Scheme, to the Laboratory for a period of two months.*

STAFF

With the resignation of Mr. H. T. Rosenberg, the staff of the Laboratory now numbers twelve, including the Superintendent, three Junior Entomologists, one Field Entomological Officer, one Secretary-Accountant-Librarian, one Caretaker, one Gardener, one Cleaner, and three Laboratory boys.

LIBRARY

Owing to the financial stringency, the library of the Laboratory has not been added to, other than by bound volumes and parts of the current periodicals on the work, and various separates sent in exchange for Laboratory contributions or presented to the Laboratory. The number of bound volumes is now 612 and the number of separates 3,457.

EQUIPMENT

As with the library, it has been impossible to add to the standing equipment of the Laboratory during the financial year under review, owing to lack of funds.

PARASITE CATALOGUE

Work on the Parasite Catalogue, which shows all records of parasites and predators, their hosts, and the country of record, as shown in the *Review of Applied Entomology*, Series A and B, has been continued by Mr. R. C. Jeffery. It is estimated that these Catalogues now contain approximately 60,000 cards.

W. R. THOMPSON,
Superintendent.

* Mr. Nangpal was occupied for the months of May and June at the Laboratory studying the various aspects of our work.

APPENDIX IV

REPORT OF THE DIRECTOR—PROFESSOR J. W. MUNRO, D.Sc.—
ON THE WORK OF THE STORED PRODUCTS RESEARCH LABORATORY,
SLOUGH, FOR THE YEAR 30TH SEPTEMBER, 1933 TO
1ST OCTOBER, 1934

INTRODUCTORY

During the year the main problems investigated by the Laboratory have concerned the infestation of tobacco by *Ephestia elutella* and of dried fruit by *Plodia interpunctella*.

The work on both problems was undertaken in the first instance at the request of overseas Governments or industrial firms, namely the Southern Rhodesian Government and the Australian Dried Fruits Board. Since the inauguration of the work other governments and industrial firms have shown their concern or interest in these problems and have contributed towards the conduct of the research. It is of interest to record that Imperial Chemical Industries have this year given a special grant for the investigation of the use of hydrocyanic acid gas as a dried fruit fumigant and that the Port of London Authority has asked for a special investigation of the insect conditions prevailing in their tobacco warehouses. It may therefore be claimed that all the work of the Laboratory is being carried out on behalf of overseas Governments or companies as well as for industrial firms in the home country.

The present position regarding these two major problems is as follows :—

INFESTATION OF DRIED FRUIT.

The crux of this problem is how to reduce the numbers of the insects which form a resident population in the warehouses at Millwall. When the Slough Laboratory undertook to assist the Australian Dried Fruits Board in dealing with the infestation problem a new system was established. Ethylene oxide was used in barge fumigation and the empty warehouses were fumigated, some with hydrocyanic acid gas, others with ethylene oxide. It was realised at the time that this fumigation of the empty warehouses would not be completely effective, because there was no information anywhere available regarding the behaviour of fumigant gases in large spaces, and that a certain proportion of the very heavy infestation of the warehouses which had accrued would have to be dealt with in the spring and summer. It was realised that the fumigation of warehouses containing fruit would be too costly and in our present state of knowledge too uncertain to be practicable. Accordingly the insect population remaining in the warehouses had to be dealt with by other means than by fumigation.

There were therefore two main lines of work to be carried out; the first dealing with the improvement of barge fumigation of fruit and the problems arising in that work and the second concerned with the devising of control measures, other than fumigation, against the insects occurring in the warehouses themselves. In addition, there was the usual routine inspection of fruit after barge fumigation to check results.

INFESTATION OF TOBACCO.

The early history of the infestation of tobacco and an account of the work done up to 1933 is given in Dr. Bovingdon's report (E.M.B. 67) published in July, 1933. Since that date the full extent of the infestation throughout all the tobacco-growing countries has become clearer. There seems to be little doubt that the moth *Ephestia elutella* has been a pest of tobacco in the Near Eastern and Mediterranean countries for a number of years and that this area may be regarded as the source of the now world-wide occurrence of infestation in the tobacco trade.

Unfortunately this does not relieve other countries or areas of their difficulties. But it is helpful in this respect that we have now a better understanding of what this problem really is.

It was obviously necessary to investigate further methods of controlling infestation of tobacco in warehouses and here again the work done consists in further study of fumigation methods, study of other means of controlling infestation of warehouses and inspection work at the docks to determine the status of infestation from time to time.

PROGRESS OF WORK

INFESTATION OF DRIED FRUIT.

(1) *Laboratory Work.*

The laboratory work is divisible into two sections: entomological and chemical. Because the entomological work done is the same whether the products concerned are dried fruit, tobacco, or cocoa, it is convenient to consider it first.

The entomological work is concerned chiefly with detailed studies of the biology of the Phycitid moths of the general *Ephestia* and *Plodia* and of certain beetles such as the grain weevil which are of secondary importance to the Phycitid moths. Good progress has been made in this work and as a result ample stocks of insects have been reared for experimental purposes. At first sight this appears a minor contribution towards the control of insect infestation but it cannot be too strongly emphasised that unless large numbers of insects are available for experimental work control methods cannot be properly undertaken. Indeed, I believe it is correct to say that the entomological work which has made really large numbers of insects available for experimental work, notably in the study and testing of control measures, is a chief merit of the Laboratory's research.

Apart from supplying insects for investigations within the Laboratory we have also been able to provide stocks of insects for work on insecticides now being undertaken in the laboratory of Imperial Chemical Industries and to provide insects for work on the control of bed-bugs which present a special problem in slum clearance.

The experimental entomological work at Slough is hampered for lack of special apparatus notably a range of incubators for the study of the effects of temperature on the rate of development.

The chemical work of the Laboratory has been concerned with further study of the methods of determining fumigants in the air space and of determining residual fumigant in stored products. Special attention is being given to problems arising in the use of hydrocyanic acid as a fumigant for dried fruit. The reason for this work is that although ethylene oxide continues to be satisfactory it is too expensive to be used for the fumigation of fruit in large warehouses and it is unlikely to be used on a large scale overseas, as for instance in Australia. The advantage of ethylene oxide is that the residues left in the fruit are, so far as is known from a study of the literature and from practical experience, innocuous. Hydrocyanic acid on the other hand has been said to produce cyanhydrins in dried fruit and very little is known concerning this question and its importance in food stuffs. It is satisfactory to be able to report that this special work is being financed by Imperial Chemical Industries.

Other work in the chemical section is concerned with the study of the moisture content of dried fruit under varying conditions of stowage and the Australian Dried Fruits Board has provided for a special assistant for this work.

Further investigation of apparatus for the delivery or release of fumigant gases—of which ethylene oxide and hydrocyanic acid are much the more important—has been undertaken and an improved type of apparatus for use with ethylene oxide has been devised for use by the Australian Dried Fruits Board.

Special work which has received some attention and will be further followed up as funds and opportunity allow concerns the study of the suitability of various building materials for the construction of fumigation chambers and warehouses and other buildings. Work on these problems has been suggested to us by the Port of London Authority and other wharfingers.

An urgent need of the chemical section at Slough is a large fumigation chamber for the conduct of experiments intermediate between laboratory work and wholesale commercial work.

Special attention has been given to the devising of an insecticide spray to deal with the insects surviving in the warehouses. Originally a proprietary spray consisting of extract of pyrethrum in white oil was used for this work but was not found to be wholly satisfactory. Intensive work has been carried out and a much better insecticidal spray has been produced and is now in general use at Millwall. The spray is applied under pressure in the form of a fine mist, and is used primarily against moths emerging from crevices in the brickwork and plaster and from the dunnage and other materials present in the warehouses.

(2) *Field Work.*

Field work undertaken in investigating the infestation of dried fruit has been concerned mainly with sampling of fruit to arrive at a knowledge of the status of infestation, of the efficiency of barge fumigation and of the insecticidal spray. The chemical section has been concerned with occasional analysis of fumigant, occasional testing of barge fumigation, and field experimental work directed towards the improvement of fumigation methods.

Field work has also been carried out in the ports of Bristol and Glasgow relating to fumigation problems and infestation of warehouses.

A marked improvement has been achieved in the storage of Australian dried fruit. Ten years ago the Australian Dried Fruits Board adopted a system of fumigation and this for a time appeared to check infestation. Soon, however, it became evident that the system had various defects and the Slough Laboratory was asked to investigate the general problem but especially the question of fumigation. Subsequently the present system was adopted on the recommendation of the Laboratory. The reduction in infestation has been marked and it is felt that better results will be achieved next year. It may even be safe to say that the system now in use by the Australian Dried Fruits Board is one of the most, if not the most, efficient in the dried fruit industry.

In concluding this brief account of the dried fruit work our thanks should be expressed to the Australian Dried Fruits Board and their staff for the many facilities given us for investigational work and for their whole-hearted co-operation throughout.

INFESTATION OF TOBACCO.

(1) *Laboratory Work.*

The experimental work relating to the infestation of tobacco has followed similar lines to those of the dried fruit work. A special study has been made of hydrocyanic acid gas as a fumigant for tobacco, particularly with reference to residues remaining in the tobacco and their effects on aroma, flavour and smoking qualities generally. The results of the work show that the normal dosages given for tobacco fumigation are too low to penetrate fully into bales and hogsheads at a concentration lethal to all stages of *Ephestia*. Higher dosages can, however, be given without affecting aroma, flavour or smoking qualities. On the other hand, one of the more important tobacco manufacturers hesitates to use hydrocyanic acid in this country and has asked that ethylene oxide be further investigated for this purpose. This work is being undertaken.

The work done has included actual fumigation experiments especially to determine the penetration of the gas in bales and hogsheads and also to ascertain the amount of residual hydrocyanic acid left behind on fumigation at high concentrations.

As has already been explained, infestation of warehouses is a most important problem and special experimental work has been undertaken to determine whether the insecticidal spray used in the dried fruit warehouses can be safely used in tobacco warehouses where taint from the oil might have been feared. It is satisfactory to report that this spray can be quite safely used in tobacco warehouses and that it has been approved by one of the big tobacco combines. Experiments have also been carried out to ensure that no fire risks attached to the use of this spray, and here again results are wholly satisfactory.

(2) *Field Work.*

The field work carried out in the tobacco warehouses has been undertaken mainly to ascertain to what extent infested tobacco still arrives in this country and to what extent certain warehouses in London are infested by the moth *Ephestia elutella*. With regard to the first question it has been shown that where infestation is high in the packing-sheds of the producing country correspondingly high infestation is shown in the tobacco on arrival in London. This tallies remarkably with results obtained two years ago in investigating dried fruit problems and almost warrants the assumption that there is a direct correlation between infestation in the producing country and infestation on arrival at the home ports.

In sampling tobaccos arriving in London to determine the amount of infestation it was found that certain tobaccos affording distinct evidence of having been fumigated in the country of origin still harboured living *Ephestia* larvæ. This confirms our opinion that in the United States of America, and probably elsewhere also, the dosages given during fumigation do not allow sufficiently for such causes of reduced concentration as leakage, absorption and poor penetration. It is evident that dosages of 16 ounces of hydrocyanic acid per 1,000 cubic feet of space are far too low for efficient fumigation of tobacco and that 24 to 30 ounces may be necessary.

A special investigation of the tobacco warehouses of the Port of London Authority was undertaken in the early summer. The full results of this are not yet available, but it is gratifying that the Port of London Authority are taking an active interest in infestation problems.

In dealing with tobacco, as with dried fruit, the study of infestation of warehouses has received special attention and it may be useful to explain why this is important. Infestation occurs in the producing country, during transport and during storage in the importing country. Even if the first two types of infestation were dealt with, commodities imported into infested warehouses would still run the very real risk of infestation during storage there. At the same time it is evident that methods for the control of insects in the warehouses in the importing country will, with slight modification, apply to infestation during transit and infestation in the producing country. Accordingly it is quite proper that the Slough Laboratory should concentrate on this problem. This view has recently been endorsed by the Australian Dried Fruits Board which, when it was suggested that parallel investigations to those in progress in the Slough Laboratory should be carried out in Australia, decided that it was more important to strengthen the Slough staff and hasten its work than to have two parallel investigations going on at a slower pace.

For similar reasons it was felt that it was more expedient to concentrate on the two products, dried fruit and tobacco, than to extend the work to other produce such as grain. A stage has now been reached in the work when the problems are becoming more technical, and the solution of any one of them will apply not merely to products immediately concerned but to stored products generally. For example, the special spray devised for dried fruit warehouses has been found to be immediately applicable to tobacco warehouses and with minor modifications will probably be applicable generally. The scientific principles underlying fumigation and the use of insecticides now under investigation form the background for control work not only in dried fruit and tobacco infestation but in all forms of infestation.

MISCELLANEOUS INVESTIGATIONS.

A study of the biology of the house mite, *Glycyphagus domesticus*, undertaken on behalf of the High Wycombe and District Furniture Manufacturers Federation has been completed and it is evident that the eradication of this mite in the furniture trade depends on proper treatment of Algerian fibre with certain dyes which will inhibit the fungal growth which forms the main food supply of the mite. This question will be further investigated as funds and opportunity permit.

Work on the resistance of insects to fumigants has been continued. A satisfactory apparatus has now been devised for studying the toxicity of fumigants and experimental work on the grain weevils (*Sitophilous* species) and on the bed-bug (*Cimex lectularius*) has made good progress.

Work has been begun on the action of insecticides and will be continued.

Vacuum fumigation has received some attention and in particular a special type of vacuum chamber has been devised which is adapted for the fumigation of small quantities of stores. This work was carried out at the request of the Department of Agriculture in Trinidad, to whom a chamber has now been sent by the engineering firm with whom we co-operated.

At the request of the Forest Products Research Laboratory of the Department of Scientific and Industrial Research a special programme of work on the fumigation of timber against wood-boring insects has been arranged and will be carried out in co-operation with that laboratory.

INDUSTRIAL RELATIONS

The general problem of infestation and its control still presents the difficulty arising from the unwillingness of some of the parties concerned to accept responsibility for infestation or to recognise that all the parties involved must co-operate in dealing with infestation. This difficulty is being gradually overcome and it is hoped that, if the good progress made in the control of dried fruit infestation justifies publicity being given to that work, industrial firms which are still hesitant may be induced to take action. The nature of the work done at the Slough Station has of course rendered publicity difficult but it is hoped that a fuller appreciation of the value of the work in all quarters may overcome this disadvantage.

IMPORTANCE OF THE WORK TO THE VARIOUS GOVERNMENTS OR GOVERNMENT DEPARTMENTS AND COMPANIES OVERSEAS

While it is easy to assess the value of *ad hoc* investigations for particular countries or industries it is always difficult to assess the value of basic research work. On the other hand the work done at Slough on the behaviour of gases under different conditions such as occur in vacuum chambers, barges, ships and warehouses; on the methods of determining gases or vapours like ethylene oxide, hydrogen cyanide and orthodichlorobenzene; on the determination of residues of these substances absorbed and retained by various products; on the formation of cyclins in fruit and other products; on the resistance of insects to fumigants and other insecticides to high and low temperatures; and on the behaviour, development and physiology of insects is of interest to all workers not only on stored products infestation but on economic entomological problems generally. In the long run this work is more important than the temporary cure of an outbreak of empirical methods.

It is a defect of empirical work that it does little to advance knowledge and while, as is shown by the work for the dried fruit and tobacco industries, empirical work necessarily figures very largely in the programme of the Slough Station it is more and more evident what the basic problems underlying infestation are and how important and urgent the need is for research on them. In so far as possible, the longer range basic research work is borne by a private benefaction, made to the Slough Station when the Empire Marketing Board was abolished, but it is felt that government departments or industrial companies both at home and overseas ought to contribute something towards that kind of work which is essential even to *ad hoc* investigations. It is not sufficiently realised that neglect of basic research work in the past is responsible for the lack of knowledge which in almost every problem handicaps the economic entomologist.

Basic research is quite properly best undertaken in university institutions, in government research institutes or in the research laboratories of industrial firms. These last two play a very important part in the physical and chemical sciences but because the biological sciences are only now entering manufacturing industry, as distinct from agriculture, their importance is yet not sufficiently realised. The result is that the background or basic research work on which the economic entomologist must build is still too limited. The university zoology departments as a whole have found the best outlet for their graduates in medicine or in research basic to medicine and in consequence the basic research which they have done has been suggested to the needs of medicine. The Imperial College is unique in that its department of zoology and applied entomology to which the Slough Station is attached has been built up independently of medical teaching and medical science. On the other hand it has not had the advantage of the support which medical science can give and is almost wholly dependent for support on the

interested in industrial problems. The consequence is that increased support from industry for the Slough Station will come slowly and meanwhile it is urgently necessary to secure adequate financial support for the nucleus staff engaged on basic research.

The work carried out at Slough during the past year is of direct interest and importance to all those government departments and companies concerned with dried fruit problems such as Australia, South Africa and Canada, to those concerned with tobacco problems such as Southern Rhodesia, Nyasaland, Australia, South Africa and the home country, and, because of the good progress made in the study of fumigation and other control methods, to those countries interested in the infestation of grain and leguminous seeds, a problem which is present in all the countries of the British Empire.

PUBLICATIONS

- H. H. S. BOVINGDON An improved laboratory apparatus for fumigation experiments.
Ann. Appl. Biol. Vol. XXI, No. 4, 1934.
- A. D. HANNA The male and female genitalia and the biology of *Euchalcidea caryobori* Hanna (Hymenoptera, Chalcididae).
Trans. Ent. Soc. London. 82, 1934.
The description of a new species of *Euchalcidea*.
Ann. Mag. Nat. Hist. (10) 13, 1934.
- G. V. B. HERFORD An automatic humidity control.
Ann. Appl. Biol. Vol. XXI, 1934.
- A. M. HORA On the biology of the mite, *Glycyphagus domesticus* De G. (Tyroglyphidae, Acarina).
Ann. Appl. Biol. Vol. XXI, 1934.
- G. H. MANSBRIDGE The breeding of *Ephestia kühniella* Z. in large numbers for experimental work.
Ann. Appl. Biol. Vol. XX, 1933.
- M. J. NORRIS Contributions towards the study of insect fertility.
II. Experiments on the factors influencing fertility in *Ephestia kühniella*.
Proc. Zool. Soc. London, 4, 1933.
Contributions towards the study of insect fertility.
III. Adult nutrition, fecundity and longevity in the genus *Ephestia*.
Proc. Zool. Soc. London, 2, 1934.
- A. B. P. PAGE and
O. F. LUBATTI The application of fumigants to ships and warehouses.
I. Distribution of ethylene oxide in empty warehouses.
II. Distribution of hydrogen cyanide in empty warehouses.
III. Penetration of hydrogen cyanide into bags of raw cacao stacked in piles of different sizes.
J. Soc. Chem. Industry, Vol. LII, No. 40, 1933.

J. W. MUNRO,

Director.

APPENDIX V

PUBLICATIONS

1. ANNUAL REPORTS OF THE EXECUTIVE COUNCIL OF THE IMPERIAL AGRICULTURAL BUREAUX:

						s.	d.
FIRST REPORT:	1929-30	..	..	..	..	1	0
SECOND REPORT:	1930-31	..	..	..	..	1	0
THIRD REPORT:	1931-32	..	..	..	..	1	0
FOURTH REPORT:	1932-33	..	..	..	..	1	0
FIFTH REPORT:	1933-34	..	..	..	..	4	0

2. LIST OF AGRICULTURAL RESEARCH WORKERS IN THE BRITISH EMPIRE, 1934. 2s.

Obtainable from the Secretary, Executive Council, Imperial Agricultural Bureaux, 2 Queen Anne's Gate Buildings, London, S.W.1, and from H.M. Stationery Office at the addresses shown on cover.

THE JOURNAL OF DAIRY RESEARCH

Published by the Cambridge University Press on behalf of the Committee of Management. First issued in November, 1929.

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Single parts	10	0
VOLUME VI (three parts)	25	0
Single parts	10	0

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							s.
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* Volumes XXIV (1933) onwards will be priced at 37s. 6d. as they become back volumes.

Review of Applied Entomology.

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Back Volumes—Vol. I (1913)-VII	15	0		10 0
Vol. VIII (1920)-XXII (1934)*	24	0		12 0
Bound Volumes (extra to above prices)	5	0		5 0
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The index to the current volume is not published until April (Series "B") or August (Series "A") of the following year.

* Volumes XXIII (1935) onwards will be priced at 42s. for Series "A" and 21s. for Series "B" as they become back volumes.

Zoological Record—Part Insecta.

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	s.	d.
Annual Subscription (including postage)	15	6
Back Volumes:— Vols. LII (1915)-LVII (1920)	12	0
Vols. LVIII (1921) <i>et seq.</i>	15	0

Postage extra.

An Abstract of the Legislation in Force in the British Empire Dealing with Plant Pests and Diseases up to the Year 1920.

By E. Marguerite Ralfs, B.A. Med. 8vo. 65 pp. Paper Covers. Price, 2s. 6d. 1921.

Tsetse-Flies. Their Characteristics, Distribution and Bionomics, with some account of possible Methods for their Control.

By Major E. E. Austen, D.S.O., and Emile Hegh. Med. 8vo. 188 pp. With 5 plates and 19 figures. Paper Covers. Price, 7s. 6d. Postage 4d. extra. 1922.

Locusts and Grasshoppers. A Handbook for their Study and Control.

By B. P. Uvarov. Imp. 8vo. Pp. xiii and 352. With 9 plates and 118 text figures. Bound in Buckram. Price 21s. net. Postage, inland, 9d.; abroad, 1s. 3d. 1928.

The Coconut Moth in Fiji. A History of its Control by means of Parasites.

By J. D. Tothill, D.Sc., T. H. C. Taylor, B.Sc., and R. W. Paine, B.A. Containing a full account of the successful campaign against this important coconut pest. Imp. 8vo. Pp. vi and 269. With 12 coloured and 22 black-and-white plates, 1 map, and 121 text figures. Bound in Buckram. Price, 31s. 6d., net. Postage, inland, 9d.; abroad, 1s. 3d. 1930.

A List of the Entomologists Employed in the British Empire.

Prepared for the Third Imperial Entomological Conference, 1930. Med. 8vo. 16 pp. Paper covers. Price, 2s. 6d. 1930.

A Summary of Data Relating to Economic Entomology in the British Empire.

Prepared for the Third Imperial Entomological Conference, 1930, by S. A. Neave, M.A., D.Sc. Med. 8vo. 24 pp. Paper covers. Price, 2s. 6d. 1930. (At present out of print.)

Report of the Third Imperial Entomological Conference, 17th-27th June, 1930.

Med. 8vo. 59 pp. Paper covers. Price, 2s. 0d. 1930.

Orders may be sent direct to the Assistant Director, Imperial Institute of Entomology, 41, Queen's Gate, London, S.W.7, or through a bookseller.

PUBLICATIONS OBTAINABLE FROM THE IMPERIAL MYCOLOGICAL INSTITUTE KEW, SURREY.

Journal

Review of Applied Mycology.

Annual Subscription, 12 monthly parts, with title-page and index (post free)	s. 21
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Occasional Publications

Annotated Account of Fungi Received at the Imperial Mycological Institute.

List I	s. 1
List II, Fasc. 1	1
List II, Fasc. 2	5

Report on the Third Imperial Mycological Conference, 1934.

PUBLICATIONS OF THE IMPERIAL AGRICULTURAL BUREAUX

I. Obtainable from the Imperial Bureau of Soil Science, Rothamsted Experimental Station, Harpenden, Herts.

Periodical Abstracts

Lists of publications and papers on Soil Science published in the Empire Overseas in 1930	s. 1
" " " " " " " 1931	1
" " " " " " " 1932	1
" " " " " " " 1933	1

(The list for 1929 is out of print.)

List of Publications relating to Soils and Fertilisers—

Published monthly (Nos. 2, 5, 6, 7, 8, 9, 18 and 20 are out of print), per annum	10
Monthly Letters—Numbers 1-36 (Nos. 2, 3, 4, 6, 8, 10, 11, 12, 13, 16 and 17 are out of print). Free to recipients, within the British Empire, of "Publications relating to Soils and Fertilisers."	
Subscription, outside the Empire, per annum	4
Recent Developments in Soil Analysis—Quarterly Supplement to the above publications. Separate copies, each	0

Occasional Papers

Technical Communications.

7. Methods of taking Soil Profiles	0
10. The Arrangement of Field Experiments and the Statistical Reduction of the Results (by R. A. Fisher and J. Wishart)	1
11. Note on an Area of Alkali Land in Western Australia	0
13. The Second International Congress of Soil Science	1
14. Weights and Measures occurring in Agricultural Publications of the Empire Overseas	0
15. Soil Survey for Irrigation Purposes in South Africa	1
16. Soil Erosion. Supplementary Note	0
17. Proceedings of a Conference on Soil Science Problems, September, 1930	1
19. Air Survey in relation to Soil Survey (by R. Bourne)	1
20. Lucerne "Inoculation" and the Factors affecting its Success	1
21. Summaries of Papers read at the Sixth International Congress of Tropical and Sub-tropical Agriculture, Paris, 1931	0
23. The Reclamation of Alkali Land in Hungary (A. A. J. de'Sigmond)	1
24. Laterite and Laterite Soils	2
25. The Mitscherlich, Wiessmann and Neubauer Methods of Determining the Nutrient Content of Soils (by R. Stewart)	2

Technical Communications—continued.

	s.	d.
26. The Dispersion of Soils in Mechanical Analysis	2	0
27. Land Amelioration in Germany (by H. Janert)	2	0
28. Soil Erosion (by T. Eden)	2	0
29. Soil, Vegetation and Climate	2	0
30. The Determination of Exchangeable Bases in Soil	2	0
31. Soil Deficiencies and Plant Diseases	2	0
Annual Report: For the year 1929-30	0	6
" " 1930-31	0	6
" " 1931-32 (out of print)	0	6
" " 1932-33	0	6
" " 1933-34	0	6

Bibliographies.

Bibliography on Sisal	1	0
Bibliography on Tobacco	2	0
Bibliography on Coffee	2	0
Catalogue of Journals and Periodicals in the Library of Rothamsted Experimental Station	2	0

Special Publication.

The Katamorphism of Igneous Rocks under Humid Tropical Conditions (by the late Sir J. B. Harrison)	5	0
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II. Obtainable from the Imperial Bureau of Animal Health, Veterinary Research Laboratory,
New Haw, Weybridge, Surrey.

Abstracting Journal

	s.	d.
The Veterinary Bulletin.		
1931. Vol. 1. Quarterly (1st Number, April)	7	6
Annual Subscription	20	0
Subsequent Volumes. Monthly (1st Number, January)	5	0
Annual Subscription	40	0
(Back Numbers still available.)		

Indexing Publication

Index Veterinarius—Four issues a year. First quarter, 1933. Annual Subscription (postage paid)	80	0
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III. Obtainable from the Imperial Bureau of Animal Nutrition, Rowett Research Institute,
Bucksburn, Aberdeen.

Journal

Nutrition Abstracts and Reviews. (Issued under the direction of the Imperial Agricultural Bureaux Council, the Medical Research Council and the Reid Library).		
Subscription per Volume of 4 numbers	21	0
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*Occasional Papers***Technical Communications.**

1. A. I. V. Silage	0	6
2. Nutrition in Relation to Reproduction with Special Reference to Sterility in Farm Animals	0	6
3. Recent Research on Forage Crop Cultivation, Fodder Conservation and Utilisation, at the Animal Breeding Institute of the University, Königsberg	1	0
4. Problems of Animal Nutrition and Animal Husbandry in Northern Rhodesia	1	0
5. Recent Research in Poultry Nutrition, by A. R. G. Emslie	1	0

OCCASIONAL COMMUNICATIONS.

1. The Effect of Climate on the Composition of Pasture Plants	—	
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IV. Obtainable from the Imperial Bureau of Plant Genetics (for crops other than Herbage)
Plant Breeding Institute, School of Agriculture, Cambridge.

<i>Journal</i>		
Plant Breeding Abstracts.		
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